# Chapter 31. Credit Derivative Products

Rangarajan K. Sundaram

Stern School of Business
New York University

# Outline

# Credit Derivatives: Objectives

- This segment aims to familiarize students with the range of credit derivatives available today, with a particular focus on the workhorse of this market: credit default swaps or CDSs.
- We examine:
  - Single-name credit derivatives:
    - Total Return Swaps.
    - Credit Default Swaps.
    - Credit-Linked Notes.
    - Credit-Sensitive Notes.
  - Multi-name products:
    - Basket default swaps
    - Synthetic CDOs
    - The CDX and iTraxx indices.
- The measurement and pricing of credit risk is the subject of Chapters 32-34 and is not a key focus of this segment.

# Credit Derivatives

- Conventionally, finance distinguishes between two kinds of risk, **market risk** and **credit risk**.
- **Market risk**: Changes in equity prices, bond prices, commodity prices, interest rates, exchange rates, index levels, ...
  - Handled using conventional derivatives such as futures, forwards, options and swaps.
- **Credit risk**: Risk that promised payments will not materialize.
  - Credit risk came into particular prominence in the mid-90's.
  - Credit derivatives enable stripping and transferring credit risk in a security separately from its other risks.
  - Trading in credit risk, and especially shorting credits, becomes feasible.

# The New Directions ...

- Traditional approach to handling credit risk:
  - Limiting exposure to any single entity.
  - Lending based on relationships and evaluation of individual borrower (The 3 C's: Character, Collateral, Capacity).
- Portfolio management of credit risk requires
  - Transferability of credit risk. Enter credit derivatives.
  - New means of measuring and quantifying credit risk. Development of new default and recovery prediction models.

# Why Only Recently?

- Huge growth in market size.
  - Altman reports that payment volume in US quadrupled between 1983 and 1992 while GNP only doubled.
  - Ratio grew from 36 in 1983 to 78 in 1992.
- Growth is worldwide. S&P rated a total of
  - 13 sovereigns in 1980.
  - 30 sovereigns in 1990.
  - 62 sovereigns in 1996.
  - 125 sovereigns in 2009.
- Increased debt lowers credit quality: Only 10 US states had AAA ratings in 1996 compared to 17 in 1970.
- Changing attitudes to credit. "Debtor" versus "leverage."

# Pressures from the Banking System

- Disintermediation.
  - Traditionally, banks used to be the main lenders. Now, many new lenders: finance companies, insurance companies.
  - Capital markets have become increasingly accessible: large numbers of firms now have actual or potential access to the commerical paper market.
- Consequence for banks: Smaller, weaker credits. So, thinner margins, worsening risk-return trade-off.
- Inadequate opportunities for diversification: banks often tend to specialize geographically and industry-wise.
- Difficulties in securitization/under-developed secondary markets: so loans once made cannot be easily eliminated from the balance sheet.
- The BIS regulations (we present examples below).

# Benefits from Credit Derivatives: For the Seller

- Credit derivatives enable managing credit exposure where cash market sales impossible/undesirable by enabling the hedging and transferring of risk. Essentially, shorting credits is feasible.
- Active management of external (regulatory) and internal (e.g., restrictions on lines of credit to individual borrowers) constraints. Superior portfolio management and balance-sheet benefits result.
- Decomposing and stripping risks from securities: Credit risk can be managed independently of other risks (e.g., convertible arbitrageurs hedging out credit risk in convertibles).
- And, of course, identifying mispricing and exploiting arbitrage opportunities.

# Benefits from Credit Derivatives: For the Buyer

- Access to a new asset class (e.g., loans) to which access was available only to limited market participants earlier.
- Credit derivatives enable leveraged exposure to credit risk and potential yield enhancement.
- Tailored investments: can create synthetic instruments of any desired maturity. For example, can take on 5-year credit exposure to a given entity even if there are no 5-year credits issued by that entity.
- Alternative vehicle for expressing directional views: for example, can assume credit risk instead of buying equity.
- Balance-sheet benefits.

# Types of Credit Derivatives

- Single name credit derivatives:
  - Total return swaps: Transfer **all** risk, both market risk and credit risk.
  - Credit spread products: Payoff is based on the spread component alone.
  - Credit default swaps: Payoff depends on whether or not "credit event" occurs.
  - Credit-linked notes and credit-sensitive notes: On-balance sheet versions.
  - Other exotic structures.
- Portfolio or basket products.
  - Basket default swaps: Payoff depends on how many, in a given basket of names, experience a credit event.
  - CDOs (Collateralized Debt Obligations).
  - Index products: CDX and I-Traxx.

# Outline of Discussion to Follow

- We first look at single-name credit derivatives, focusing, in particular on **credit-default swaps** (CDS).
  - CDS are by far the most important category of single-name credit derivatives.
  - They are also the building blocks for several multi-name credit derivatives including basket default swaps and synthetic collateralized debt obligations.
- The second part of the presentation looks at multi-name products.

# A Further Question

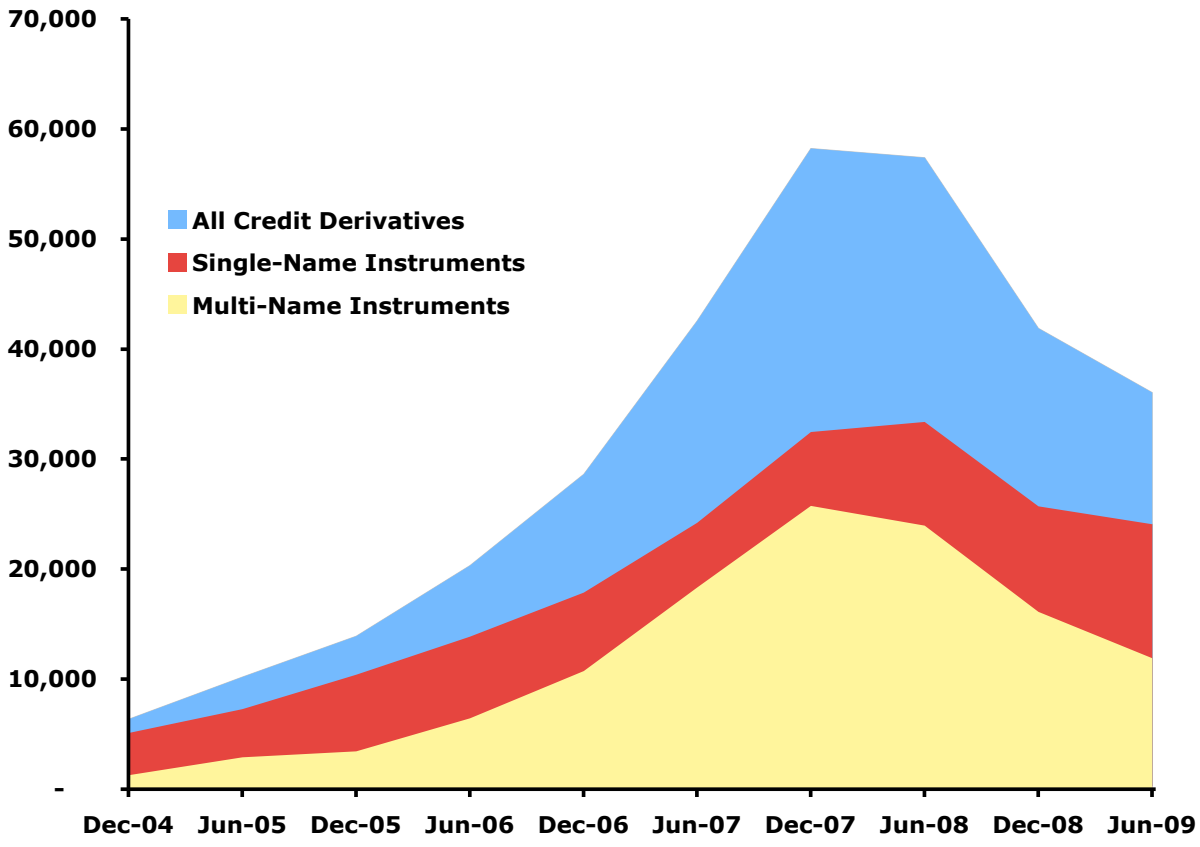
- **Measurement** and **Pricing** of credit risk.
- Key factors:
  - Probability of default.
  - Recovery in the event of default.
- The main obstacle: **unobservability**.
- Identifying credit risk and default probabilities:
  - Chapter 32: Structural Models of Credit Risk
  - Chapter 33: Reduced-Form Models of Credit Risk.
- Modeling correlated default:
  - Chapter 34: Correlated Default

# Outline

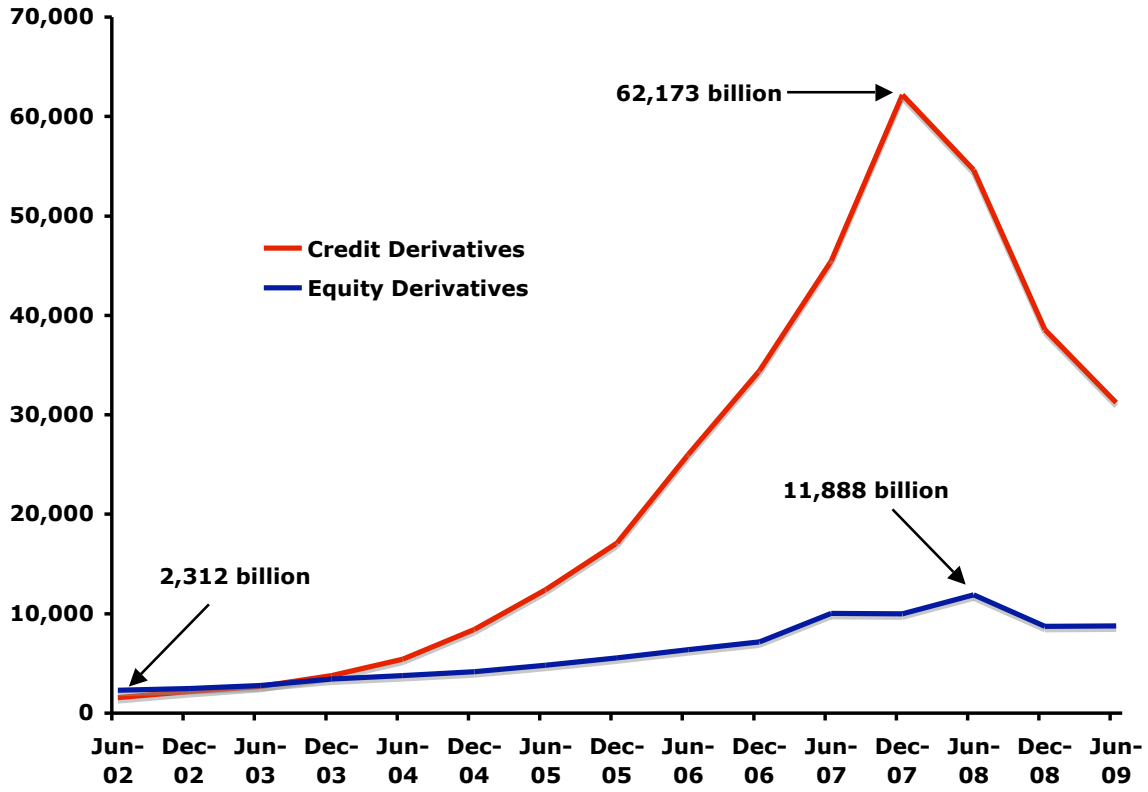
# Overview of the Market

- Over the next several slides, we present a broad statistical overview of the credit derivatives market concerning:
  - Size and growth of the credit derivatives market.
  - The credit derivatives market compared to
    - Equity derivatives.
    - US debt market.
  - The composition of the credit derivatives market.

# Size and Growth of the Market: BIS 2009

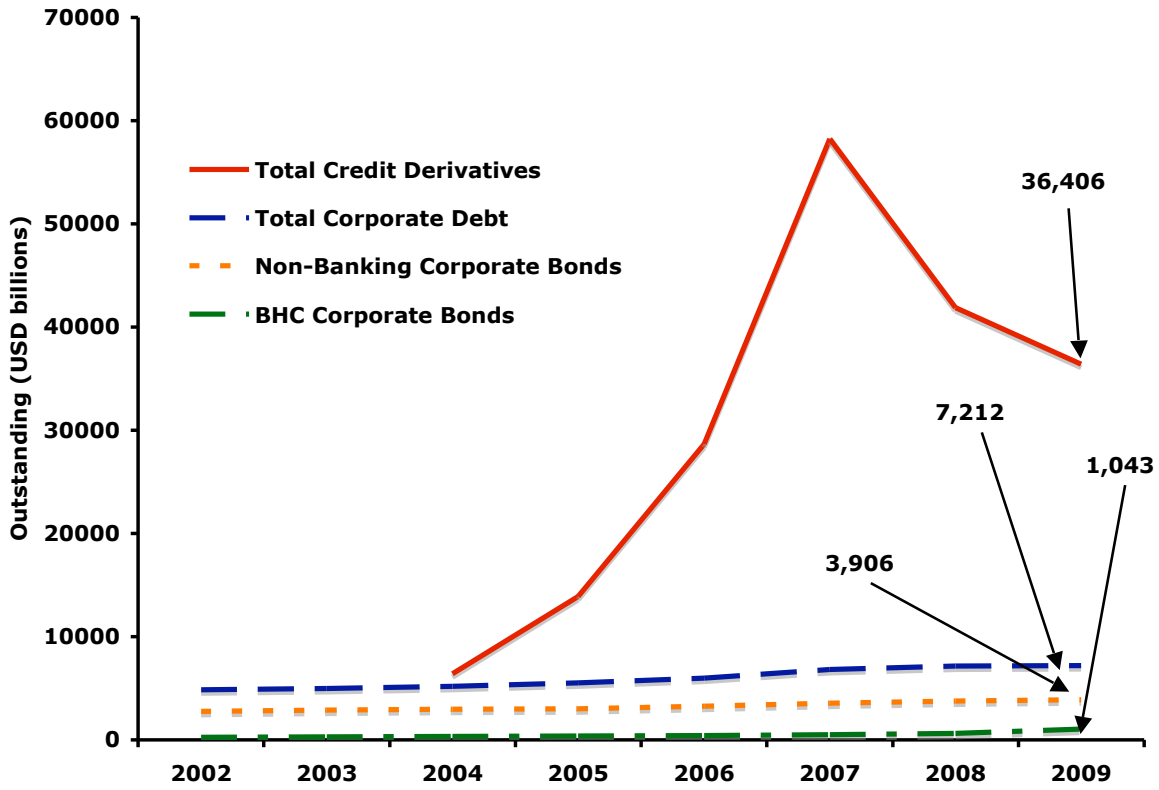


# Credit Derivatives v. Equity Derivatives



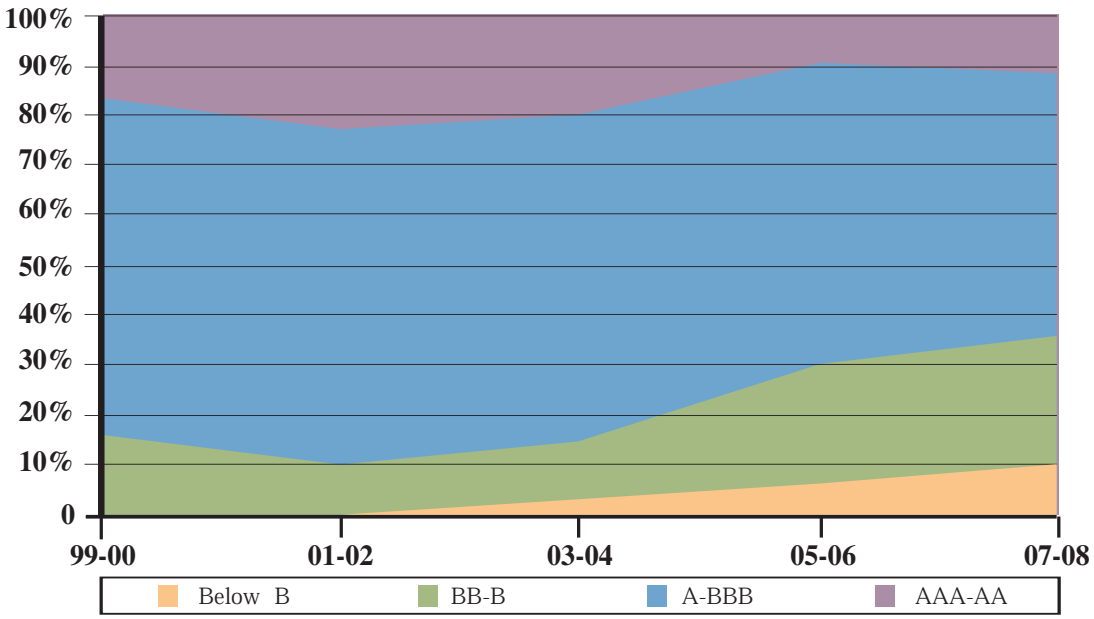

Source: ISDA Apr 2010

# Credit Derivatives v. Debt Markets



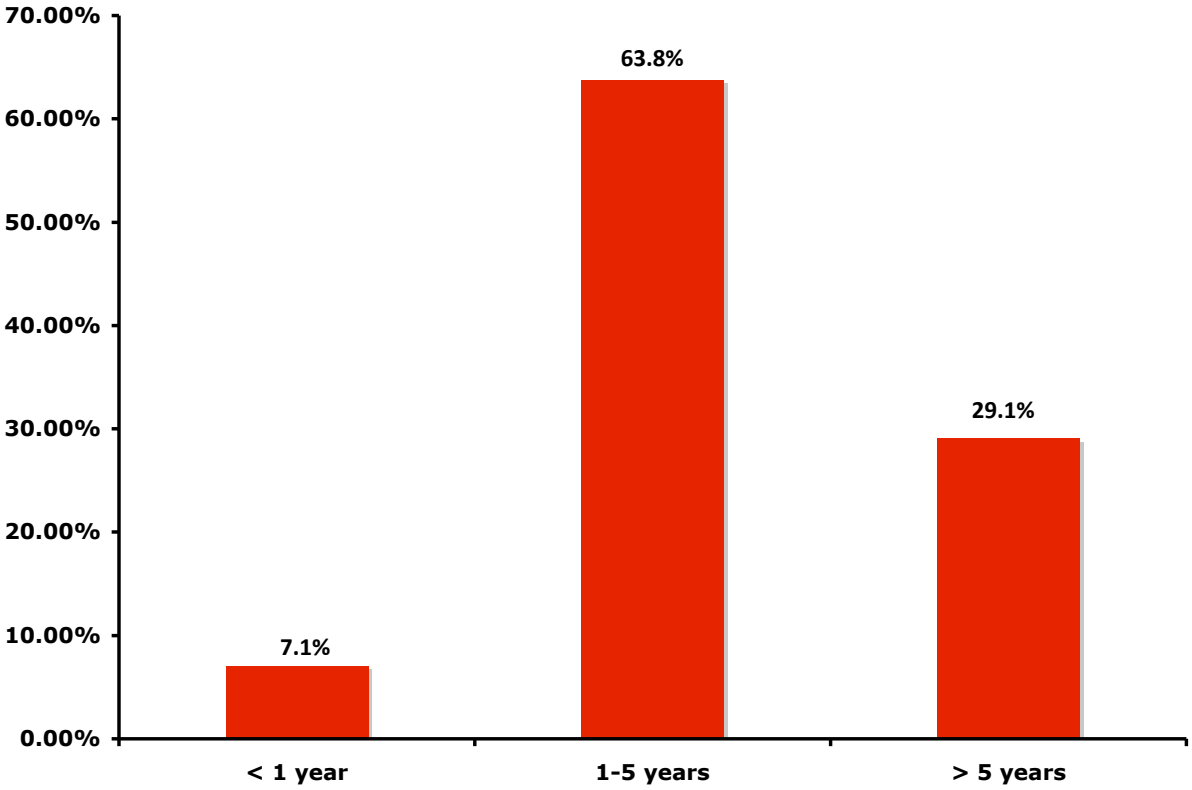

Source: Federal Reserve Board, BIS

# Reference Obligation Rating Distribution




Source: BBA

# Maturity Distribution




Source: BIS, Dec 2008

# Composition of the Credit Derivatives Market

| Type | 2000 | 2002 | 2004 | 2006 |
|---|---|---|---|---|
| Basket products | 6.0% | 6.0% | 4.0% | 1.8% |
| Credit linked notes | 10.0% | 8.0% | 6.0% | 3.1% |
| Credit spread options | 5.0% | 5.0% | 2.0% | 1.3% |
| Equity linked credit products | n/a | n/a | 1.0% | 0.4% |
| Full index trades | n/a | n/a | 9.0% | 30.1% |
| Single-name credit default swaps | 38.0% | 45.0% | 51.0% | 32.9% |
| Swaptions | n/a | n/a | 1.0% | 0.8% |
| Synthetic CDOs – full capital | n/a | n/a | 6.0% | 3.7% |
| Synthetic CDOs – partial capital | n/a | n/a | 10.0% | 12.6% |
| Tranched index trades | n/a | n/a | 2.0% | 7.6% |
| Others | 41.0% | 36.0% | 8.0% | 5.7% |

Source: BBA

# Outline

# Total Return Swaps

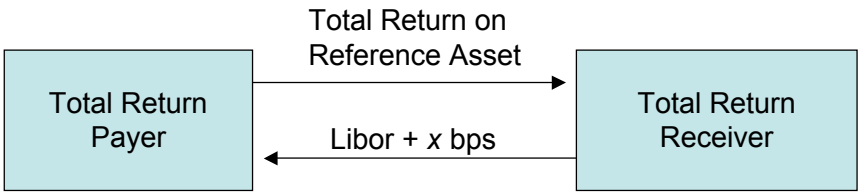
- Also called a **Total Rate of Return Swap**.
- Bilateral financial contract in which
  - one counterparty (the "TR Payer")
  - pays the **total return** on a specified asset (the "Reference Obligation")
  - to the other counterparty (the "TR Receiver")
  - in exchange for a specified cash flow (typically LIBOR plus a spread).
- The maturity of the TRS need not match the maturity of the underlying reference obligation.

# Total Return Swaps

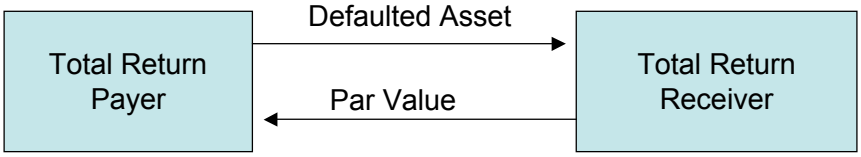
- Total Return = Sum of
  - Cash flows from the Reference Obligation (e.g., coupons)
  - Change in value of Reference Obligation.
- Change in value can be **positive** or **negative**.
  - So TR could be **negative**.
  - Negative TR $\Longrightarrow$ TR receiver makes a payment to the TR Payer.
- Change in value payments can be periodic or at maturity of the swap.
- What if Reference Obligation defaults?
  - The swap terminates with the loss-given-default being borne by the TR receiver.

# Total Return Swaps

If no default:




If reference asset defaults:



# Important Features of a Total Return Swap

- Resembles a **lease**:
  - In exchange for making regular payments, the TRS receiver obtains the "use" of the underlying asset.
  - Thus, the TRS is effectively a form of **financing**.
- Effectively, the TR Payer lends the use of the asset to the TR Receiver for the swap duration.
  - Thus, low funding-cost entities are naturally advantaged as payers in TRS transactions.
- Transfers both **market risk** and **credit risk** of the Reference Obligation.
- Importance of "mismatched" maturities: Can create new securities with maturities not currently available in the market.

# Funding Cost Arbitrage

- General idea:
  - Bank A, the "higher quality" bank, purchases the reference obligation outright.
  - Bank A then enters into a TR Swap with the "lower quality" bank, Bank B. in which Bank A pays Bank B the total return on the reference obligation in exchange for a floating rate payment of LIBOR+$x$ bps.
- Potential advantages to Bank B are apparent: it can obtain the asset cheaper than it could on its own balance sheet.
- What about Bank A?
  - What is the credit quality of the synthetic asset created?
  - Possible regulatory-capital relief.

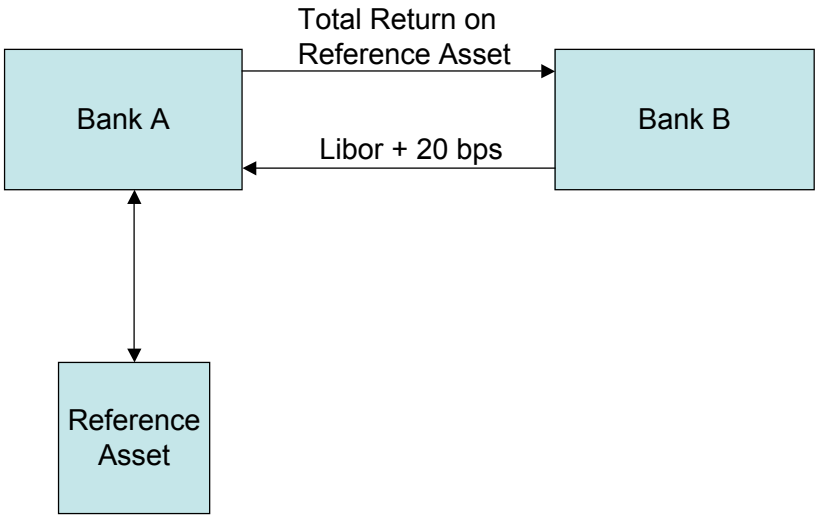
# Funding Cost Arbitrage: An Example

- Data:
  - Bank A: Rated AA, has cost of funds of LIBOR flat.
  - Bank B: Rated A−, has cost of funds LIBOR+40 bps.
  - Reference Obligation: Rated BBB, yields LIBOR+70 bps.
- If Bank B were to buy the reference obligation outright: Net spread = 30 bps.
- If Bank A buys the reference obligation, net spread = 70 bps.

# An Alternative Plan

- Alternative plan to B buying the asset outright:
  - A buys the asset.
  - A enters into a TRS with B in which B pays A Libor $+x$ in exchange for receiving the total returns from the asset.
- If $x < 40$ bps, B clearly benefits.
- What about A? Obviously, must at least have $x > 0$ bps. Other considerations:
  - What is the credit quality of the asset A holds?
  - What is the risk-weighting A receives?

# The Alternative




- Assuming zero correlation between Bank B and the reference obligation, Bank A has a synthetic asset with implied rating A+, yields LIBOR + 20 bps. Risk-weighting?
- Bank B: obtains BBB asset off-balance-sheet at LIBOR + 20 bps.

# Summary of Advantages

- Main advantages for the TR Receiver:
  - Can gain access to a desired asset class (e.g., syndicated loans) to which no access is otherwise available.
  - Can obtain access to new assets with maturities not available in the market.
  - Leverage.
- Main advantage for the TR Payer:
  - The TR Swap creates a hedge for both price risk and default risk, even while retaining ownership.

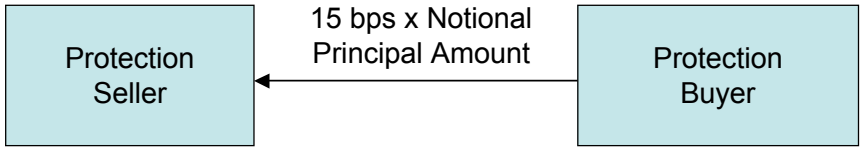
# Outline

# Credit-Default Swaps

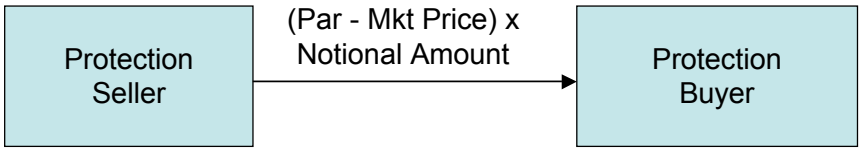
- By far the most important component of the credit derivatives market, accounting for about a third of the market volume.
- Bilateral contract in which
  - one party (the "Protection Buyer")
  - makes a periodic payment (the "CDS premium") to
  - another party (the "Protection Seller")
  - in exchange for a single contingent payment following
  - a "credit event" on
  - a specified "reference obligation".
- Maturity of CDS need **not** match that of Reference Obligation.

# Credit Default Swaps

If no default on the reference asset:




If reference asset defaults:



# Features of Credit-Default Swaps

- CDS is really a form of insurance against default: it transfers credit risk from Protection Buyer to Protection Seller (without transferring ownership).
- Note that, unlike a TR Swap, market risk in a CDS remains with the Protection Buyer.
- Maturities: range from 1 to 10 years; 5 years is the most popular.
- Expiry dates are now standardized: 20th March, 20th June, 20th Sep, and 20th Dec.
- The standardization has greatly helped improved liquidity.

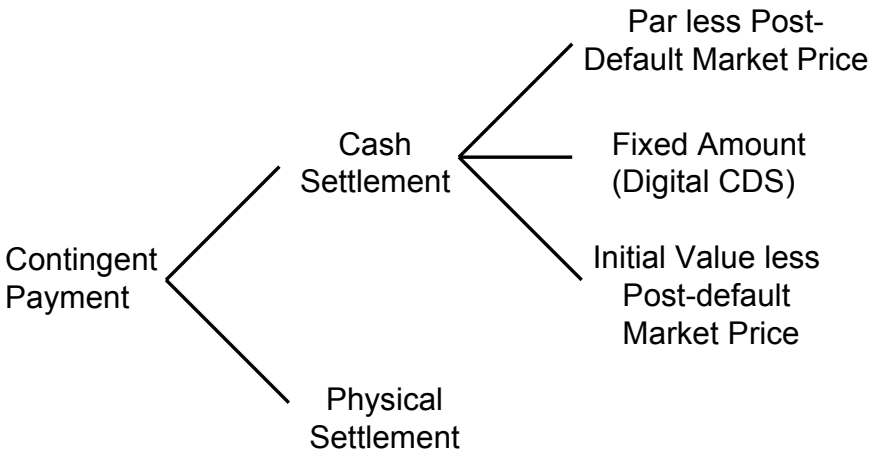
# Two Key Questions

1. What exactly constitutes a "credit event?"
2. If a credit event occurs, how is the payment to be made by the protection seller to the protection buyer determined?

# The "Credit Event"

- Technicalities aside, until the "Big Bang" of April 2009, there were three possibilities that defined a credit event in G-7 corporate contracts:
  1. Failure to pay: Subject to materiality and grace period.
  2. Bankruptcy: Corporation becomes insolvent or unable to meet its debts.
  3. Restructuring: "Soft" credit event discussed below.
- Post-April 2009: New corporate contracts in
  - North America trade without restructuring (No-R).
  - Europe continue to trade with restructuring (the Mod-Mod-R clause described below).

# Settlement Alternatives




- Deliverable obligations may be one of a class of obligations (buyer has "cheapest-to-deliver" option).
- Post-Big Bang of April 2009: North American corporate contracts are cash settled with the settlement price determined in a post-credit event auction.

# Restructuring

- The restructuring clause will trigger protection if one of the following happens:
  - Reduction in interest or principal payable.
  - Postponement of interest or principal repayments.
  - Change in priority.
  - Change in currency of payment.
- But **not** if the event does not " . . . directly or indirectly result from a deterioration in the creditworthiness of financial condition of the Reference Entity."

# The Conseco Case

- A financial-services firm, operating primarily in the insurance market, Conseco attempted to diversify into consumer financial services in 1998 when it acquired GreenTree one of the largest financiers of mobile homes in the US.
- A $350 million charge in 2000 + other bad financial news led to loss of access to the commercial paper market.
- Conseco debt was downgraded and the company had to draw on bank backstop facilities.
- Through improved operations and sale of non-strategic assets, Conseco accumulated $450 million in cash by late-2000, but had exhausted its bank facilities and faced repayment of maturing bank loans.

# The Conseco Restructuring

- Conseco's bankers agreed to extend maturity of its loans rather than push them into bankruptcy. Under the agreement:
  - Conseco would repay outstanding debt of \$450 million in full.
  - Maturity of the remaining \$900 million would be extended by 15 months.
  - Interest rate would rise from $L + 50$ to $L + 250$.
  - There would be a sort of collateralization.
- Even though market sentiment at the time was that there had been no significant change in Conseco's creditworthiness, a restructuring event **had** occurred under the definitions.

# The Conseco Case: Credit-Event Trigger

- Banks that had purchased protection triggered the contingent payment on their default swaps.
- But:
  - Bonds maturing around the same time as the bank facilities were paid in full.
  - The restructured 15-month loan was trading at around 92% of face value.
  - Long-dated senior unsecured bonds were trading at around 70% of their face value.
- Protection buyers delivered the long-dated bonds resiulting in losses of over $60 million to the protection sellers.

# The Conseco Case: Aftermath

- ISDA modified the restructuring clause in 2003.
- Four restructuring alternatives:
  - Old-R: Old restructuring clause.
  - No-R. No restructuring.
  - Mod-R: For North American corporate contracts. Maturity ($\leq 30$ months) and other restrictions on deliverable obligations.
  - Mod-Mod-R: For Europe. Maturity ($\leq 60$ months) and other restrictions on deliverable obligations.
- Until April 2009: North America Investment Grade traded Mod-R and High Yield traded No-R.

# Exploiting a Funding Advantage with CDS

- Similar to the "funding cost arbitrage" argument with TR Swaps.
- General idea:
  - Entity with low funding cost ("Bank A") buys asset.
  - Bank A then enters into a default swap with entity with high funding costs ("Bank B").
  - Bank A makes a periodic payment to Bank B in exchange for a contingent payment in the event of default.

# Points to Consider

- Considerations for Bank A:
  - Synthetic asset whose credit exposure is to **joint** probability of default of reference obligation and Bank B.
  - Regulatory capital requirements: 20% risk-weighting if Bank B is an OECD bank, 100% otherwise.
  - But **market risk** remains with Bank A.
- Principal consideration for Bank B: funding-cost savings by exploiting Bank A's lower cost of funding assets on-balance sheet.
  - May provide a profitable alternative to buying low credit-quality assets on balance sheet.

# Funding Cost Arbitrage: An Example

- Bank A: Funding cost = Libor ($L$) flat.
- Bank B: Funding cost = $L + 40$ basis points.
- Reference obligation: Currently yields $L + 60$ basis points.
- If Bank B were to buy the reference obligation:

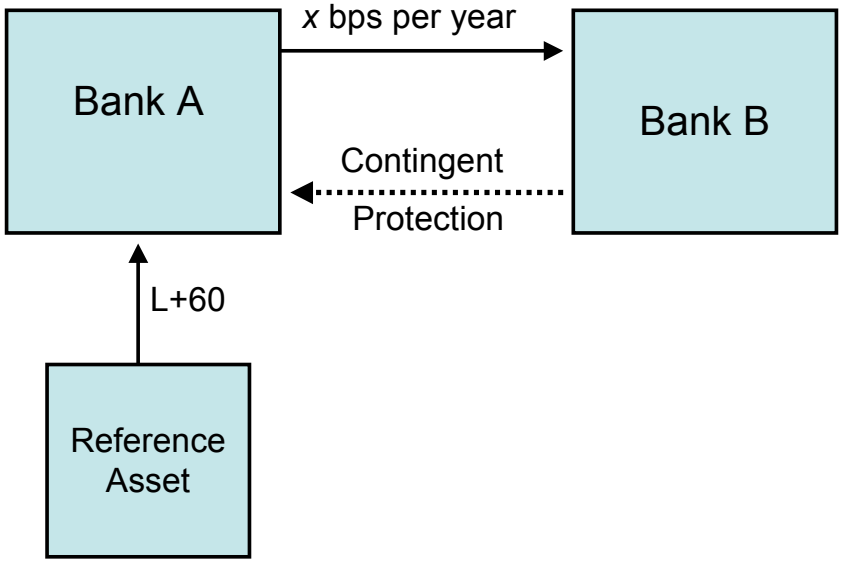
  Net Spread = 20 basis points

- If Bank A were to buy the reference obligation:

  Net Spread = 60 basis points

# A Possible Solution

- A possible solution exploiting Bank A's lower funding cost:



# Considerations for the Parties

- Must have $x \geq 20$ to make the transaction attractive to Bank B.
- Must have $x \leq 60$ or Bank A will lose money on the transaction.
- Considerations for Bank A:
  - It is lending its balance sheet, so must be able to justify the transaction on an ROE basis.
  - Default likelihood. Main concern is the probability of **joint** default.
  - Regulatory capital requirements?

# Gains from Trade

- One possible solution: $x = 28$.
- Split of surplus?
  - Bank B gains 8 bps.
    - Now receives 28 bps for taking on virtually the same credit risk.
  - Bank A gains 32 bps.
    - It receives 60 bps spread from the investment and pays 28 bps for protection.
  - Total gain: 40 bps.
    - This is exactly the funding cost savings obtained by having Bank A buy the asset rather than Bank B.
- But note that Bank A retains market risk.

# "Fair" Price of a Default Swap

- Selling protection via a CDS is akin to holding the underlying bond:
  - If there is no default on the underlying bond, we continue to receive cash flows.
  - If a default occurs. there is a loss suffered on account of fall in bond value.
- Thus, there should exist a close relationship between the CDS premium and the yield spread on the underlying bond.
- But there are also some differences between CDS and bonds.
  - For example, in a CDS, the loss given default is always measured from par. In a bond, it is measured from initial value which may or may not be par.
- As a consequence, the CDS-Bond "basis" is typically small, but not zero.

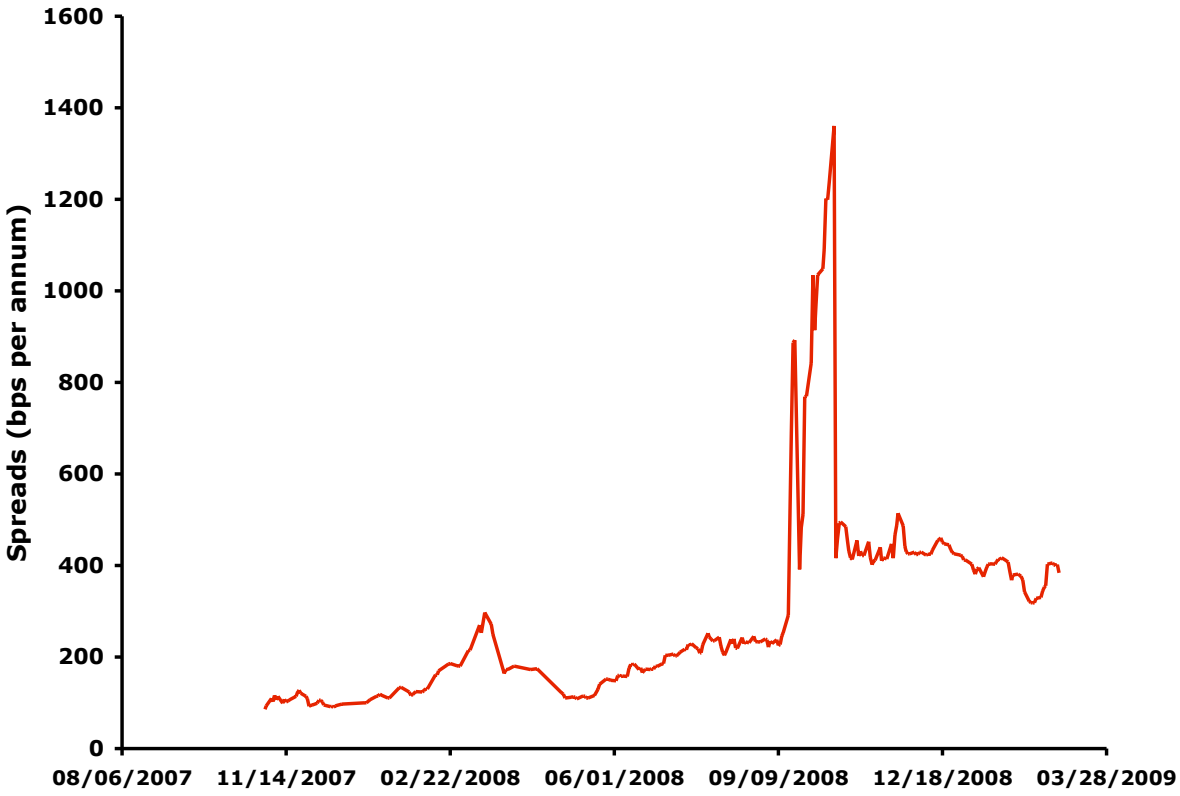
# Factors Widening the CDS-Bond Basis

- Convertible issuance.
  - Hedging demand from convertible arbitrageurs raises CDS spreads over bond spreads.
- Negative credit views.
  - Relative illiquidity of bond markets means it is easier to express negative credit views by buying protection than shorting bonds.
- Debt trading below par in the cash market.
  - CDS loss in the event of default is greater than loss on bond.

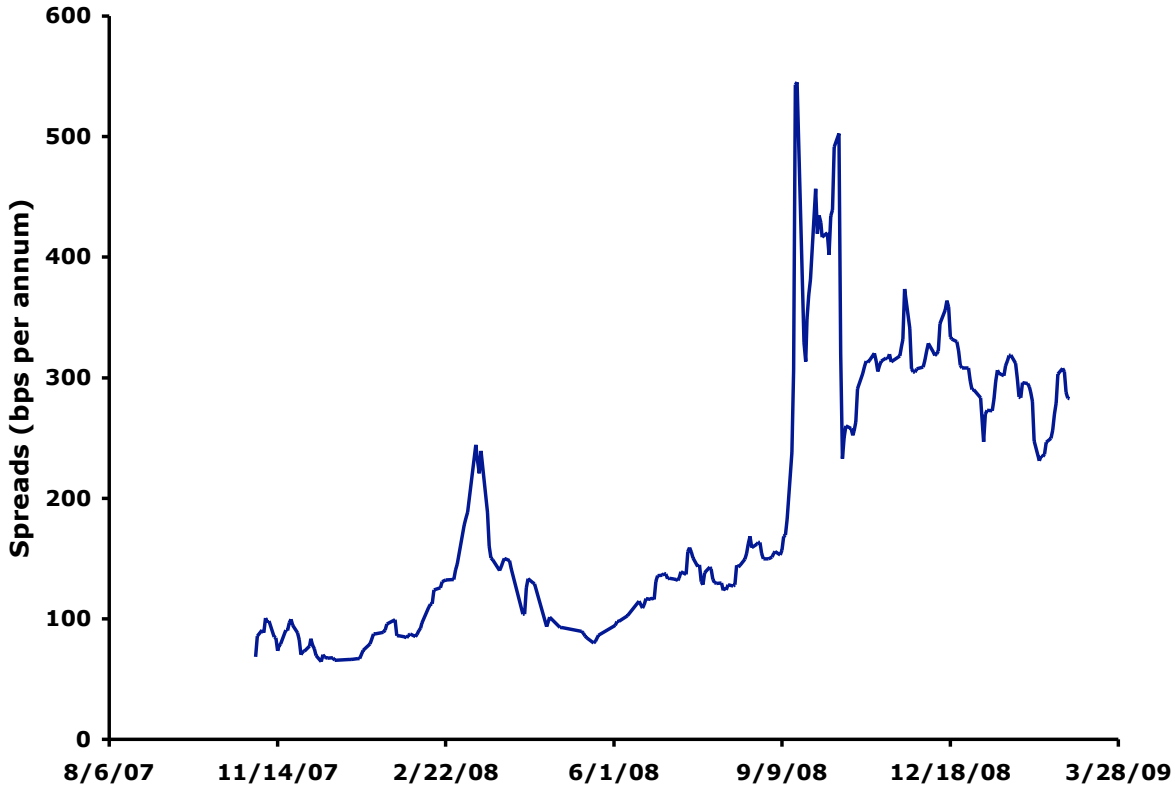
# Factors Narrowing the CDS-Bond Basis

- Use of synthetic CDOs.
  - Rise in structured credit products such as synthetic CDOs led to large-scale issuances of CDSs that depressed CDS spreads below bond spreads.
- Debt trades above par in the cash market.
  - Losses on CDS (which are measured form par) are less than the losses on the bond.

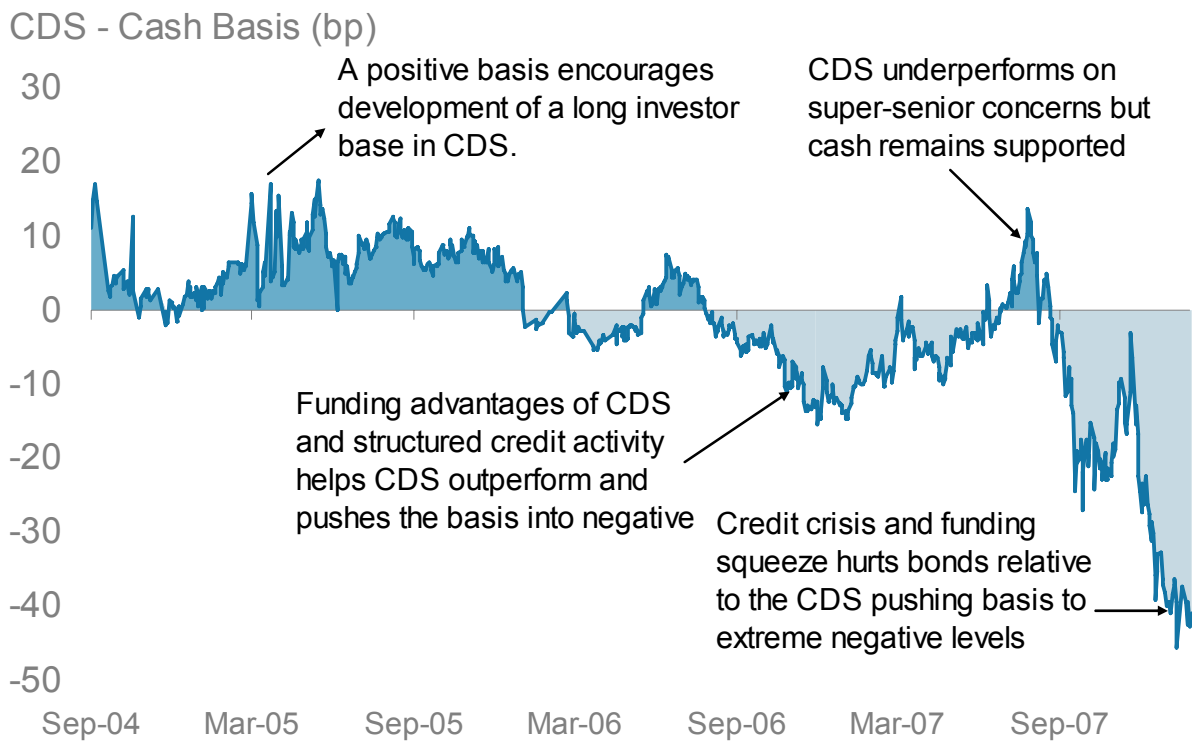
# CDS Spreads 2008: Morgan Stanley



# CDS Spreads 2008: Goldman Sachs

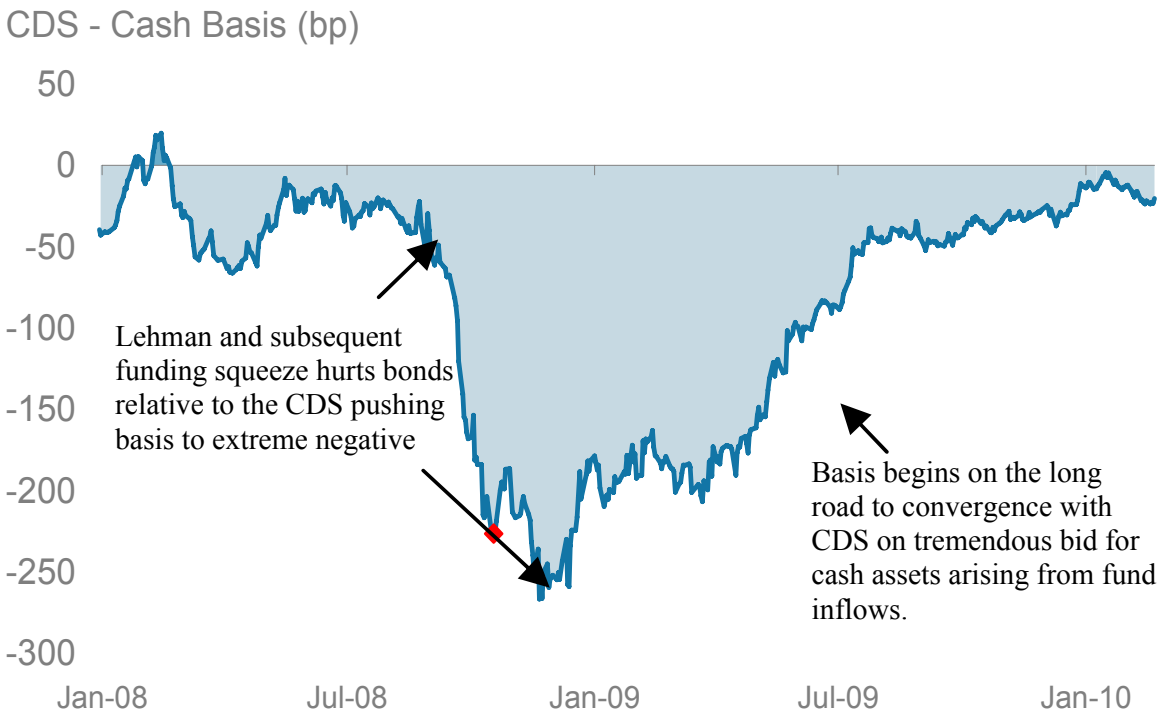


# CDS Basis Behavior: Pre-2007




Source: Morgan Stanley

# CDS Basis Behavior: Post-2007




Source: Morgan Stanley

# April 2009: The CDS "Big Bang" Summarized

- In April 2009, the CDS market went through some dramatic changes, some applicable to all new contracts globally, some only to new contracts in North America.
- The global contract changes include:
  - Hardwiring the auction mechanism into all contracts.
  - The setting-up of a Determination Committee to make binding determinations regarding credit events and succession events.
  - A standardized rolling effective date for **all** contracts. Protection is effective from
    - (the current date − 60 days) for credit events.
    - from (the current date − 90 days) for succession events.

# The CDS Big Bang: Contract Changes

- The North American convention changes:
  - All contracts will have **fixed** spreads ("coupons") of either 100 bps or 500 bps.
  - An up-front payment will be made by one counterparty to the other to reflect the difference between the market spread on the given name and the fixed coupon. The up-front payment is calculated using a standard CDS Converter model that assumes a 40% recovery rate.
  - Buyer has to make the **full** coupon payment on the first payment date. (So seller must make any required accrual rebate payments at the time of the trade.)
  - All contracts trade **No-R**.
- North American CDS contracts now similar to the CDX index.
- European CDS contracts are expected to continue to trade Mod-Mod-R.

# The CDS Big Bang

- Effect on existing positions:
  - Investors can "re-coupon" their existing trades into combinations of the 100 bos and 500 bps contracts that will leave their cash flows and risk-profiles unaltered.
  - However, new contracts trade No-R.
- The changes were accepted smoothly.

# Outline

# Credit-Linked Notes

- Credit-Linked Note: Credit derivative embedded in a note.
- Rough idea: In a CLN, the protection buyer issues a note tied to the default-performance of a reference obligation.
  - If there is no default on the reference obligation, coupon and principal repayments on the note are made as promised.
  - If there is a default, then the loss on the reference obligation is met with the proceeds from the note. Any remaining amount is returned to the protection seller.
- Thus, it is "as if" the protection buyer is receiving the cash up-front from the protection seller and returning it only if there is no default.

# Why Notes?

- Why notes? Some motivations:
  - Investors may not be authorized to use derivatives or off-balance-sheet transactions.
  - Credit lines to investor providing a hedge remain unused.
  - Correlation between investor and reference credit is now irrelevant.
  - Credit rating of investor is investor is irrelevant.

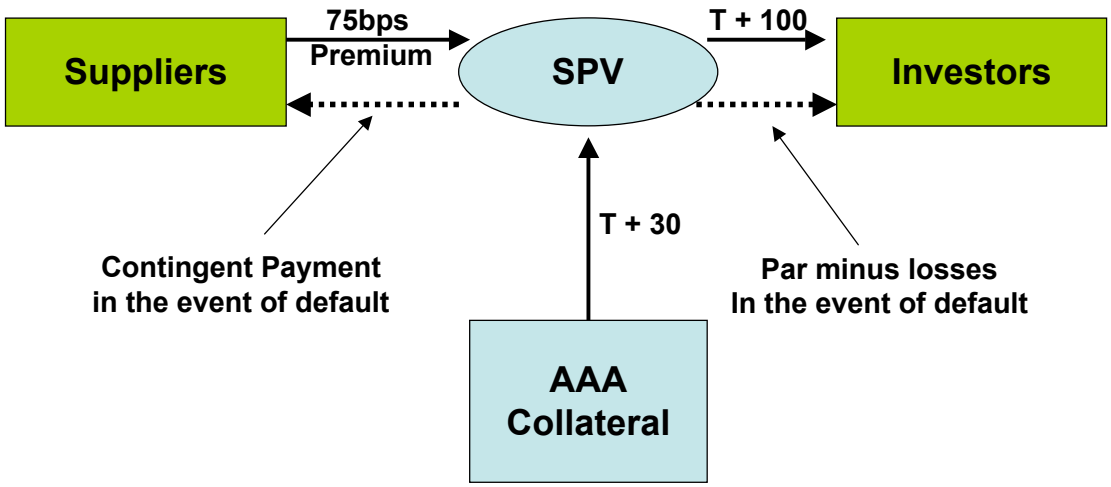
# Typical CLN Structure

- A Special Purpose Vehicle (SPV) is at the center of the CLN structure.
- The SPV issues notes whose coupon/principal payments are tied to the performance of a reference credit.
- Proceeds from the issuance of the notes are invested in pre-agreed collateral.
- The SPV also sells protection via CDS (usually to a highly-rated counterparty) in exchange for a regular premium.
- The premium and the cash flows from the collateral are used to fund the coupon payments on the notes.
- If a credit event on the reference obligation occurs, the CDS counterparty delivers the obligation to the SPV in return for par. Payments to the protection buyer are met through liquidating the collateral. Any balance and the delivered obligation are delivered to the investor.

# Default-Linked Notes: An Example

- Large manufacturer: bonds currently yielding Treasury ($T$) +90 bps.
- Special-Purpose Vehicle (SPV) issues note paying $T + 100$ bps, linked to default of manufacturer's bond.
- SPV holds AAA bonds as collateral, yielding $T + 30$ bps.
- SPV sells credit protection to suppliers of the manufacturer, receiving 75 bps as premium.
- If the manufacturer defaults, the collateral is liquidated, and investors receive residual amount after paying the suppliers.

# Default-Linked Notes: An Example




- Gain to investors?
- Gain to Suppliers?
- Gain to SPV?

# Outline

# Credit-Sensitive Notes

- Coupon levels are linked to credit rating of the issuer.
- Earliest issuer: Enron in 1989.
- Immediately followed by many others:
  - Potlatch Corp, 1989.
  - Auburn Hills Trust, Unisys Corp, and 5 others in 1990.
- Late 1990s/early 2000s: ILC Thailand (puttable bond), Deutsche Telekom, AT&T, British Airways, others ...

# Credit-Sensitive Notes: The Enron Issue

- The Enron issue:
  - \$100 million in non-callable notes.
  - Credit rating at issue time: BBB−
  - Small decline in coupon payment for rating improvement.
  - Large increase in coupon payment for rating decline.

# The Enron Credit Sensitive Note

| Moody's Rating | S&P Rating | Coupon |
|---|---|---|
| Aaa | AAA | 9.20% |
| Aa1 to Aa3 | AA+ to AA− | 9.30% |
| A1 to A3 | A+ to A− | 9.40% |
| Baa1 to Baa3 | BBB+ to BBB− | 9.50% |
| Ba1 | BB+ | 12.00% |
| Ba2 | BB | 12.50% |
| Ba3 | BB− | 13.00% |
| $\leq$ B1 | $\leq$ B+ | 14.00% |

# Advantages of the CSN Structure

- At the time of issue, typical coupon on BBB: around 10.25%
- Enron's coupon substantially smaller.
  - Costly signalling.
  - Present savings.
  - Future savings.
  - Impact on agency costs.
  - Benefit to investors.

# Outline

# Basket Default Swaps

- A **First-to-Default** (FTD) Basket is a natural generalization of a CDS.
  - As in a CDS, there is a protection buyer who makes regular periodic premium payments to a protection seller for protection against a credit event.
- Key difference: there is a **basket** of reference obligations.
  - Typical FTD baskets involve 5-10 names.
- The protection is triggered at the first point where one of the credits in the basket experiences a credit event.
- Second-to-default (STD) and *n*th-to-default (nTD) baskets are defined similarly.

# First-to-Default Baskets

- For example, consider a basket of 10 credits with a notional of \$10 million on each credit.
- The protection buyer pays the seller a regular premium (typically quarterly).
- If any of the credits experiences a credit event, the basket default swap terminates.
- The protection seller pays \$10 million in exchange for the protection buyer delivering \$10 million in face value of the defaulted credit.

# Protection Sellers: Why FTD Baskets?

- FTD baskets provide investors with leverage.
- The fair spread on a defaultable bond is given approximately by $\lambda(1-\phi)$ where $\lambda$ is the default likelihood and $\phi$ the anticipated recovery rate.
  - We explain why this is the case in Chapter 33.
- By considering a basket, rather than a single credit, $\lambda$ increases.
- As a consequence, the premium from selling FTD protection on a basket can be a multiple of the individual CDS spreads on the credits in the basket.
- "Like" selling CDS on each credit in the basket but with much lower potential losses.

# Protection Buyers: Why FTD Baskets?

- The FTD Basket swap provides a hedge against default on the portfolio of underlying credits.
- Hedge is imperfect . . .
- . . . but cost is much lower.
- Equity cushion.
- Thus, FTD Baskets provide a cost-benefit trade-off: costs of managing the imperfect hedge will determine the buyer's willingness to participate.

# The FTD Basket Spread

- The FTD Basket swap can be viewed as a basket of CDS with a knock-out feature.
- Upper and lower limits on the fair price are easily identified:
  - The FTD Basket premium cannot exceed the sum of the premia on the individual CDS.
  - The FTD Basket premium must be at least equal to the CDS premium for the weakest credit in the basket.
- Cannot be replicated with existing instruments, so model needed for pricing and valuation.

# Valuing FTD Baskets

- Valuing FTD (or, more generally, $n$TD) baskets is significantly more complex than valuing CDS.
- Valuation depends on:
  - Value of $n$ (in the $n$TD).
  - Number of credits in the basket.
  - Credit quality of each item in the basket.
  - Maturity of the default swap.
  - Individual credit curves of the credits in the basket.
  - Anticipated recovery rates on the credits in the basket.
  - . . . anything else???

# Valuing FTD Baskets

- A significant factor in determining basket premia is default **correlation**.
- Default correlation typically positive (why?).
- "Default correlation" = "survival correlation"
  - If firms tend to default together, then it means they also tend to survive together.
- In general, basket premia **decline** as correlation **increases**.
  - Probability($\geq 1$ default) $= 1-$ Probability(No defaults).
  - Prob of zero defaults increases as default correlation increases.

# Outline

# Synthetic CDOs

- A traditional "cash" CDO is a structure where the cash flows from a specified pool of reference bonds are tranched out to investors according to specified rules.
- In a synthetic CDO, the cash flows are generated by selling CDSs rather than by buying the bonds.
  - Synthetic CDOs began in the late 1990s as a mechanism for transferring credit risk off the balance sheet of banks.
  - Motive was regulatory capital management.
  - Using CDSs rather than bonds also enabled the structure greater flexibility in the timing of cash flows, etc.
  - By the mid-2000s (pre-crisis), became a much more customized and investor-driven product.
- The issuance of CDSs to fund the cash flows had a significant feedback effect on the CDS market for the underlying credits.

# Synthetic CDOs: An Example

- Consider a reference pool with 100 investment-grade names and a notional of \$10 million each. Total notional: \$1 billion.
- Cash flows from the pool are divided among three tranches: equity, mezzanine, and senior.
- The equity tranche takes all the losses due to default on the pool up to a pre-specified maximum (e.g., 5% = \$50 million).
- The mezzanine tranche takes all further losses from default again up to a pre-specified maximum (e.g., 10% = \$100 million).
- All remaining losses are absorbed by the senior tranche.

# Synthetic CDOs: An Example

- The equity tranche clearly has the greatest risk.
  - Typically unrated.
  - Receives the highest coupon.
- Mezzanine has intermediate risk: rating of BBB, for example.
- Senior tranche is least risky.
  - Typical carries a very high rating: AAA
  - Lowest coupon.

# Synthetic CDOs: An Example

- In this example: senior tranche is protected against first $150 million of losses from default.
- Assuming a LGD of 60%, one-fourth of all the credits in the pool have to default before the senior tranche is at risk.
- How likely is this to happen?
- In general, risk in senior & other tranches determined by extent of subordination.
  - Attachment point.
  - Width of tranche.

# Synthetic CDOs: An Example

- Factors affecting quality/risk level of tranches:
  - Attachment point.
  - Width.
  - Credit quality of portfolio.
  - Recovery rates anticiapted.
  - Maturity.
  - . . . and—that elusive quantity, correlation!
- The pricing of CDOs and other correlation products is examined in Chapter 34.

# Outline

# Credit Indices

- Credit indices aggregate CDS spreads in a similar manner to the aggregation of equity prices by equity indices.
- Two major families of indices:
  - CDX: North America (NA) and Emerging Markets (EM).
  - iTraxx: Europe and Asia.
- Major indices have sub-indices based on
  - Spread volatility
  - Sectors
  - Geography
  - Ratings

# North American Indices I: CDX.NA.IG

- CDS on 125 equally weighted NA Invest Grade (IG) names.
- Divided into 5 sector sub-indices:
  - Consumer
  - Energy
  - Financials
  - Industrials and Telecom
  - Media and Technology
- HVOL sub-index: 30 highest-volatility names.
- Maturities:
  - IG & HVOL: 1y, 2y, 3y, 5y, 7y, and 10y.
  - Sector indices: 5y and 10y.
- So 22 indices in all.

# CDX.NA.IG

- Credit ratings of the issuing entities span the entire IG segment.
- Concentrated in the A/BBB grades.
  - Typically, over 50% are BBB or Baa.
  - Another 30+% are A.
- This is similar to the distribution of IG ratings classes in the CDS market.
- Trade No-R (only credit events are bankruptcy and failure to pay).

# North American Indices II: CDX.NA.XO

- Crossover index consisting of 35 equally-weighted names.
- Requirements:
  - "5B" Crossover rating (e.g., IG by one agency, HY by others)
    or
  - or "4B" BB/Ba ratings
    or
  - BB/Ba by one and no rating by others.
- Typically, over 85% of names are in BB/Ba.
- Maturities: 3y, 5y, 7y, and 10y, so four indices in all.

# North American Indices III: CDX.NA.HY

- Benchmark index consisting of 100 equally-weighted NA High-Yield names.
- Three sub-indices:
  - HVOL.
  - BB index (40%-45%): All BB names in the HY index.
  - B index (about 40%): All B names in the HY index.
- Available in funded form (i.e., investor pays a cash price and receives a fixed coupon), but also available in unfunded form for certain maturities.
- Maturities:
  - HY index: 3y, 5y, 7y, and 10y.
  - Sub-indices: 5y.
- So 7 indices in all.

# European Indices I: iTraxx Europe

- Benchmark index for the European investment-grade market.
- Consists of 125 equally-weighted CDSs on European investment-grade.
- Four benchmark maturities: 3y, 5y, 7y, and 10y.
- Sub-indices:
  - HiVOL basket consisting of the 30 names with the widest bid-offer spreads.
  - 7 Sector baskets.
- 24 indices in all.
- Two-thirds of names come from UK, France, and Germany.

# European Indices II: iTraxx Crossover

- 40 equally-weighted European crossover names.
- Eligibility based on both ratings and spread criterion (CDSs must be trading in a range).
- Maturities: 5y and 10y.
- No sub-indices.
- Two-thirds of names come from UK, France, and Germany.

# How the Indices Work

- Each CDX or iTraxx index is like a CDS on a basket of names. Specified by
  - Start date.
  - End date.
  - Premium (running payment).
  - Notional.
- "Equally-weighted" $\Rightarrow$ notional on each name is the same.
  - For example, consider selling protection on \$100 million of the CDX.NA.IG index.
  - Since the index consists of 125 names, the notional on each name is \$0.80 million.
  - Thus, selling \$100 million of protection on the index is (roughly) equivalent to selling \$0.80 million of protection on each individual name.

# Index "Rolls"

- Each index is 'rolled" every 6 months.
  - Rolling is the process by which new names are introduced and some old names dropped from the previous index.
  - The process is governed by transparent rules and is based on dealer polls.
- Each roll increases the maturity of the on-the-run indices by 6 months.
- The composition of the old indices is not affected. They continue to trade as before.
- Traders wishing to remain with the on-the-run indices must close out their existing positions and open new ones in the on-the-run indices.
- New indices may trade wider or narrower than the previous index.

# Pricing Conventions

- Each index comes with a fixed spread or coupon.
- The spread represents the running premium payment received by sellers of protection on the index.
- Since the market price of protection on the basket of CDSs represented by the index will typically differ from this fixed spread, an up-front payment/receipt is required to compensate the seller and buyer.
- This up-front payment is equal to the (risky) present value of the difference between the market spread and the fixed spread.
- The CDX.NA.HY and EM indices are quoted on a price rather than a spread basis.

# Pricing: An Example

- Suppose that on 01-Feb-2009, an investor wishes to sell protection on \$1 billion of the 5-year CDX index maturing on 20-Dec-2013.
- Suppose that the fixed spread on the index is 100 basis points, and that the current market spread is 163 basis points.
- Then, the investor will receive a running premium payment of approximately

$$0.25 \times 0.010 \times 1,000,000,000 \;=\; 2,500,000.$$

- In addition, the investor will receive an up-front payment equal to the risky present value of 63 bps on the notional principal amount of \$1 billion.

# What Happens if there is a Default?

- If a component of the index experiences a credit event, then the protection seller compensates the protection buyer via either physical or cash settlement.
  - Restructuring is not a credit event in CDX contracts, unlike in the pre-Big Bang US CDS contracts.
  - The iTraxx European indices, however, do use Mod-Mod-R as a credit event.
  - For simplicity, we use the terms "default" and "credit event" interchangeably.
- Following a credit event, the defaulting name is then removed from the index. The index continues to trade on the remaining names.
- The notional and all subsequent premium payments are reduced proportionately to reflect the altered portfolio.

# Default: An Example

- For example, suppose a buyer has purchased €125 million of protection on the iTraxx Europe index (i.e., €1 million per name), and there is a credit event on one name.
- The protection seller then compensates the buyer for the loss-given-default on that name on a notional of €1 million via either physical or cash settlement.
- All subsequent premium computations are on a notional of €124 million.
- For example, if the running premium is 75 bps, then the new quarterly payments are approximately

$$0.25 \times 0.0075 \times 124,000,000 \;=\; 232,500.$$

# Outline

# Summary

- Credit derivatives constitute the most rapidly-growing segment of the derivatives market.
- Single-name credit derivatives are large a chunk of this market, and credit-default swaps are by far the most popular type of single-name credit derivative.
  - The structure of CDS contracts went through major changes in April 2009.
  - Today, the contracts are more standardized than ever before.
- An increasing share of the market is now occupied by the recently-introduced index products such as the iTraxx and CDX indices.