

# Credit Default Swaps

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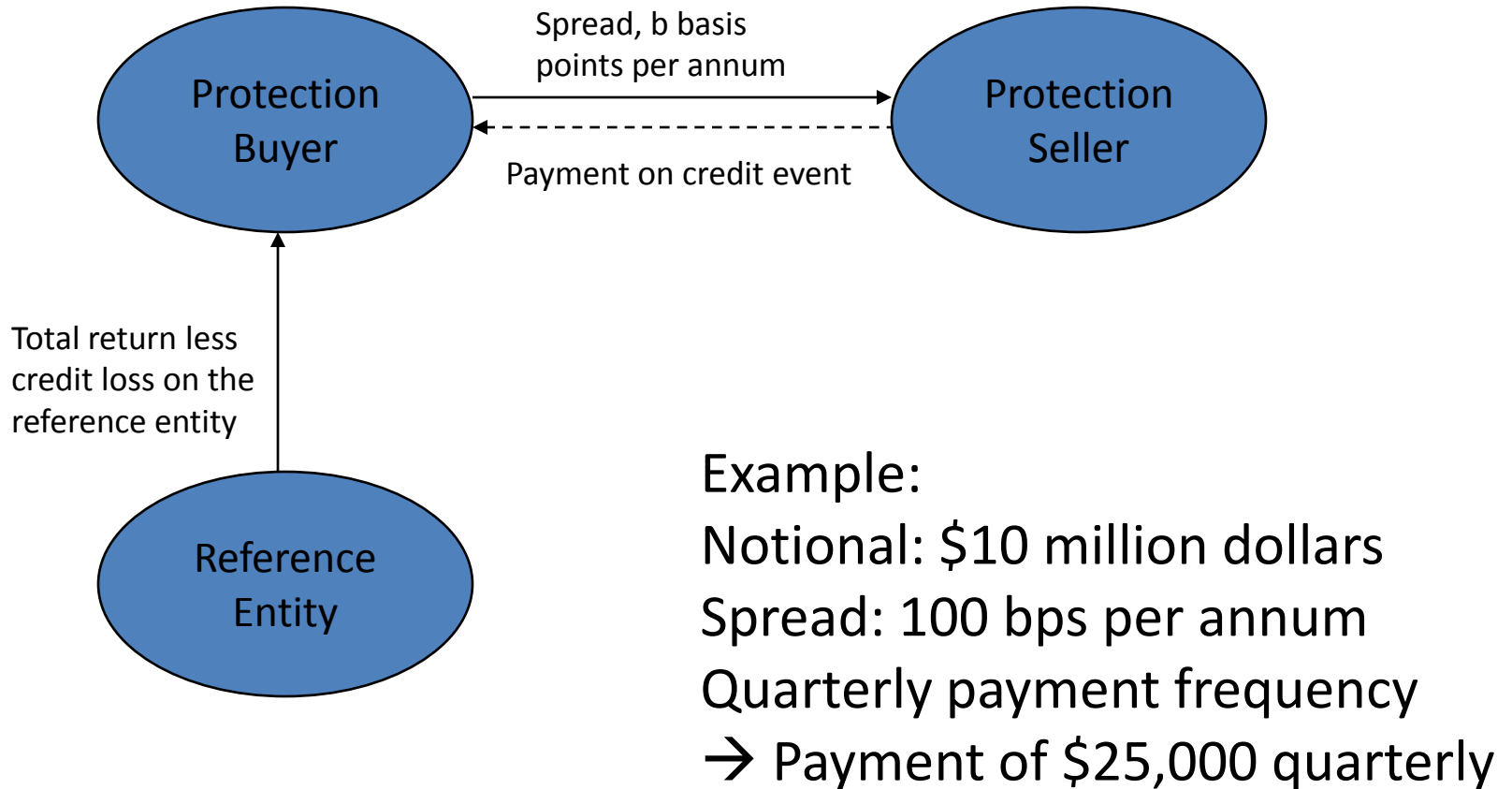
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# Credit Default Swaps – Definition

- A credit default swap (CDS) is a kind of insurance against credit risk
  - Privately negotiated bilateral contract
  - Reference Obligation, Notional, Premium (“Spread”), Maturity specified in contract
  - Buyer of protection makes periodic payments to seller of protection
  - Generally, seller of protection pays compensation to buyer if a “credit event” occurs and contract is terminated.

# Credit Default Swaps – Example



# Credit Default Swaps - Types

- Exist for both corporate reference entities and Asset Backed Securities (ABS)
  - Corporate CDS are relatively simple; first emerged round about 1993; became widely used by late 90's/early 2000's, particularly after introduction of ISDA template in July 1999
  - ABS CDS are more complex; first appeared around 2003; grew substantially in 2005 after introduction of ISDA “Pay as you go” template in June of that year
    - Exist for a variety of types of ABS; most common for Residential Mortgage Backed Securities (RMBS); but, size of markets for CDS on CDOs and CDS on CMBS also substantial.

# Credit Default Swaps – Credit Events

- For corporates, quite straightforward
  - Credit event results in payment from protection seller to buyer and termination of contract
  - Most common types of credit events are the following
    - Bankruptcy
      - Reference entity's insolvency or inability to repay its debt
    - Failure to Pay
      - Occurs when reference entity, after a certain grace period, fails to make payment of principal or interest
    - Restructuring
      - Refers to a change in the terms of debt obligations that are adverse to creditors
  - If credit event does not occur prior to maturity of contract (typically, 2/5/7/10 years for corporates), protection seller does not make a payment to buyer

# Credit Default Swaps - Settlement

- For corporates, settlement process is rather simple
  - Cash Settlement
    - Dealer poll conducted to establish value of reference obligation (for example, x percent of par)
    - Protection seller pays buyer  $100 - x$  percent of Notional
      - CDS can be thought of as a put option on a corporate bond. Protection buyer is protected from losses incurred by a decline in the value of the bond as a result of a credit event.

# Example of Cash Settlement

- The protection buyer in a 5,000,000 USD CDS, upon the reference entity's filing for bankruptcy protection, would notify the protection seller. A dealer poll would then be conducted and if, for instance, the value of the reference obligation were estimated to be 20% of par, the seller would pay the buyer 4,000,000 USD.

# Credit Default Swaps – Settlement - Continued

## – Physical Settlement

- Protection buyer sells acceptable obligation to protection seller for par
  - Buyer of protection can choose, within certain limits, what obligation to deliver. Allows buyer to deliver the obligation that is “cheapest to deliver.” Generally, the following obligations can be delivered
    - » Direct obligations of the reference entity
    - » Obligations of a subsidiary of the reference entity
    - » Obligations of a third party guaranteed by the reference entity



# Credit Default Swaps – Payment Events for CDS on ABS

- CDS referencing ABS are more complex
  - Attempt to replicate cash flows of reference obligations
    - Reflective of growing importance of ABS CDO market in early/mid 2000's
- Floating Amount Events: Do not terminate contract
  - Writedown
    - Reduction in principal of reference obligation
    - Implied writedown
      - Calculated based on under-collateralization of reference obligation
      - Optional for CDS on CDOs

# Example of an Implied Writedown

- Consider a CDO with two tranches; senior tranche has notional of 150,000,000 USD; Subordinate tranche has notional of 150,000,000 USD. If there's only 225,000,000 USD of collateral backing the deal, subordinate tranche will experience a 50% implied writedown.

# Credit Default Swaps – Payment Events for CDS on ABS - continued

## – Principal Shortfall

- Reference Obligation fails to pay off principal by its legal final maturity (typically approximately 30 years)

## – Interest Shortfall

- Amount of interest paid on reference obligation is less than required
- Three options for determining size of payment from seller to buyer: Fixed Cap, Variable Cap, No Cap

# Credit Default Swaps – Payment Events for CDS on ABS - continued

- Fixed Cap: Maximum amount that the protection seller has to pay buyer is the Fixed Rate
- Variable Cap: Protection seller has to make up any interest shortfall on the bond up to LIBOR plus the Fixed Rate
- No Cap: Protection seller has to make up any interest shortfall on the bond

# Comparison of Fixed, Variable and No Cap – Assuming CDS Spread of 200 bps

Bond Coupon	Fixed Cap-Max Pmt	Variable Cap-Max Pmt	No Cap-Max Pmt
LIBOR + 150 bps	200 bps	LIBOR +200 bps	LIBOR + 150 bps
LIBOR + 200 bps	200 bps	LIBOR +200 bps	LIBOR + 200 bps
LIBOR + 250 bps	200 bps	LIBOR + 200 bps	LIBOR + 250 bps

# Credit Default Swaps – Payment Events for CDS on ABS - continued

- Physical Settlement Option – Buyer has option to terminate contract
  - Writedown
  - Failure to Pay Principal
  - Distressed Ratings Downgrade
    - Reference obligation is downgraded to CCC/Caa2 or below or rating is withdrawn by one or more agencies

# CDS on ABS – Additional Fixed Payments

- In corporate CDS, protection buyer will never owe seller anything other than premium
- Not necessarily the case for CDS on ABS
  - Recovery of interest shortfall or reversal of principal writedown can result in protection buyer reimbursing protection seller

# CDS Pricing and Valuation

- Premium, “spread” – quoted as an annual percentage in basis points of the contract’s notional value, but usually paid quarterly.
- Like the premium on a put option, where the payment of the premium is spread over the term of the contract.
- Model expected payments and expected losses
  - Likelihood of default
  - Recovery rate in the event of default
  - Liquidity, regulatory and market sentiment about the credit



# CDS Pricing – Continued

- Value of CDS (to protection buyer) = Expected PV of contingent leg – Expected PV of fixed leg.

Expected PV of fixed leg:

$$\sum D(t_i)q(t_i)Sd + \sum D(t_i)\{q(t_{i-1})-q(t_i)\}S*d_i/2$$

↑  
The present values of the sum of all payments to the extent they will likely be paid (i.e., taking into account survival probability)

↖  
The present values of all expected accrued payments

Where:  $D(t)$ =discount factor for date  $t$ ,  $q(t)$ =survival probability at time  $t$ ,  $S$ =annual premium,  $d$ =accrual days (i.e., 0.25), Notional of \$1 million

# CDS Pricing – Continued

- Expected PV of contingent leg:

$$(1-R)\sum D(t_i)\{q(t_{i-1})-q(t_i)\}$$

- The spread is set initially so that the value of the CDS is 0.

$$\sum D(t_i)q(t_i)Sd + \sum D(t_i)\{q(t_{i-1})-q(t_i)\}S^*d_i/2=(1-R)\sum D(t_i)\{q(t_{i-1})-q(t_i)\}$$

$$S = \frac{(1-R)\sum D(t_i)(q_{i-1} - q_i)}{\sum D(t_i)q(t_i)d_i + D(t_i)(q_{i-1} - q_i)\frac{d_i}{2}}$$

# CDS Pricing – Example

Two portfolios – same maturity, par and nominal values of \$100  
Portfolios should provide identical returns at time  $T_1$   
→ CDS spread = corporate bond spread

$T_0$  – Portfolio A:

Long: Risk Free Bond

Short: CDS of a Company  
(i.e., “Selling Protection”)

$T_0$  – Portfolio B:

Long: Company’s Corporate Bond

$T_1$  – No Default:

Risk free bond’s payoff: \$100

No payment made on CDS

Corporate bond’s payoff: \$100

$T_1$  – Credit event: Assume a recovery rate of 45%

Risk free bond’s payoff: \$100

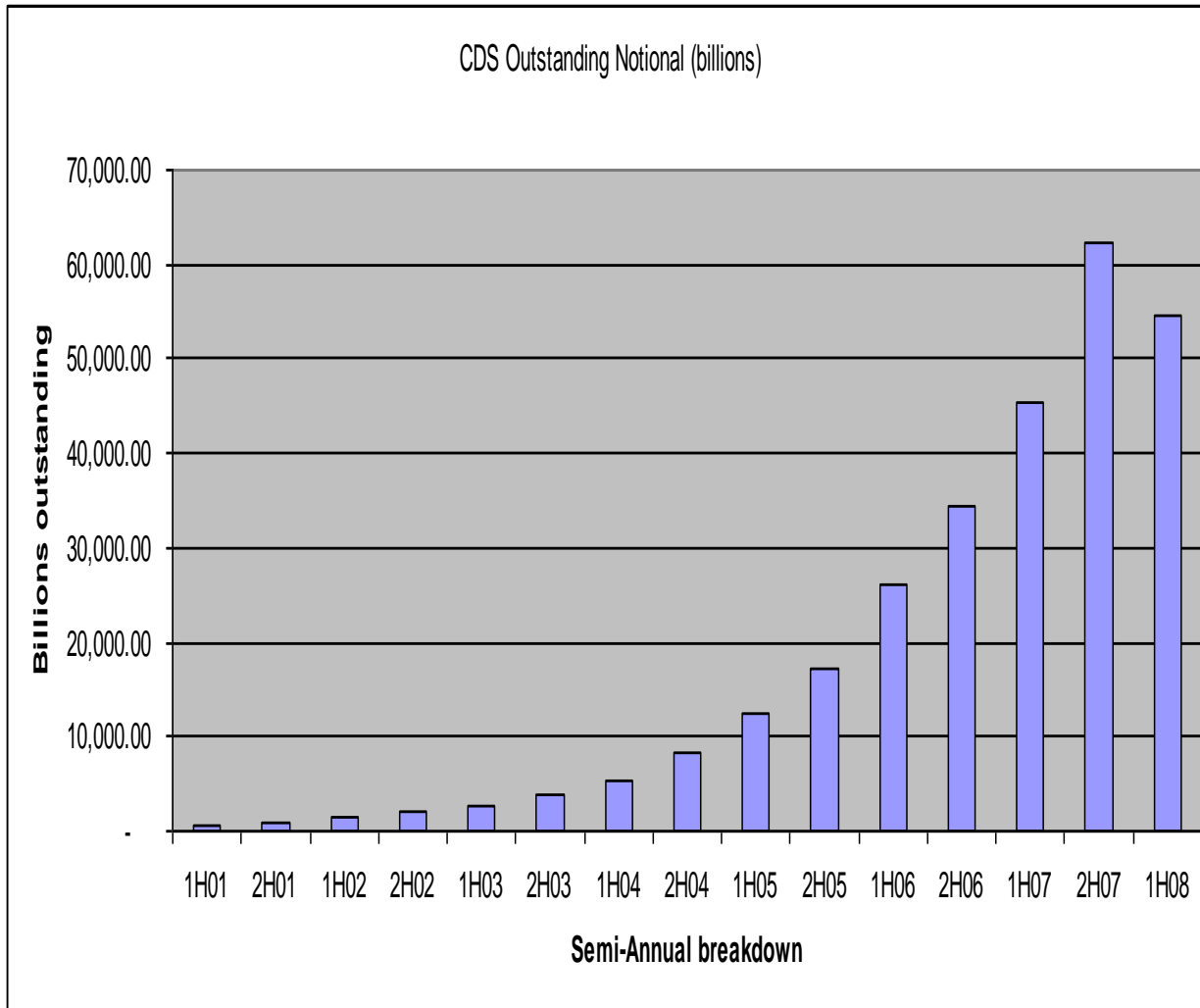
Payment on CDS: 55% of \$100 notional

Corporate bond’s payoff: \$45

# Negative Basis Trades

- Investor buys a bond and buys protection on the same entity. If the basis is negative – the credit default swap spread is less than the bond spread – the trader can receive a spread without taking on any default risk. However, the investor takes on counterparty risk.
- For example, suppose a bank structures a CDO and takes down a AAA tranche paying a spread of 27bps. The bank can then buy protection from an insurer (such as AIG) for 17 bps, pocketing 10 bps.

# Growth So Far



# Systemic risks

- Risks that threaten the broader financial market not just individual participants
- Previous examples where mechanisms caused systemic risk
  - Bank runs
  - Portfolio insurance – stop-loss failures
    - Works individually but not if everyone does it

# Measuring risks in the CDS market

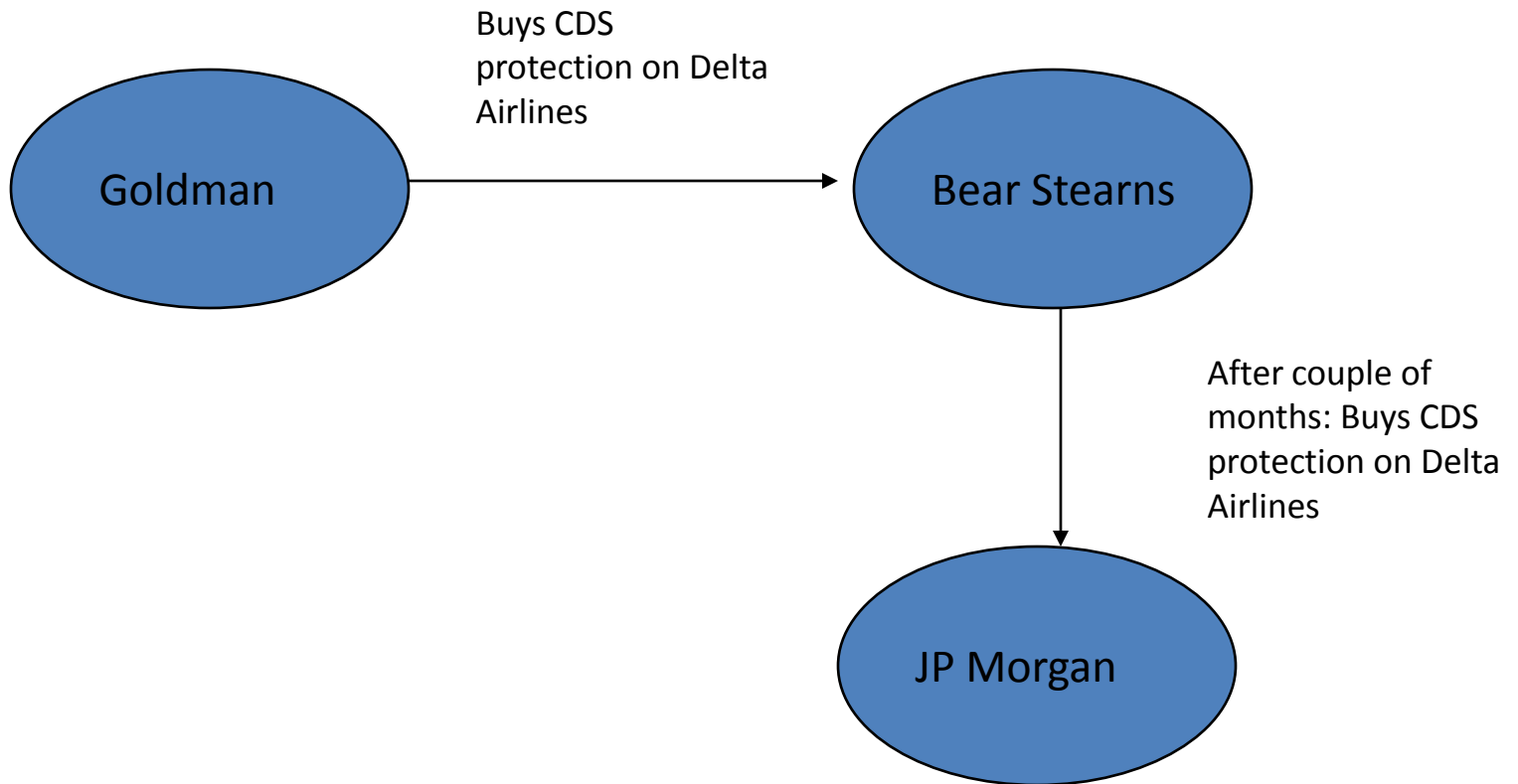
- Do we know the total risk exposure out in the market?
- Notional does not give us a good measure:
  - Actual payment is measured in basis points of notional.
  - In case of credit event, made whole on the underlying bond
- Double counting each side of contract
- Netting

# Netting

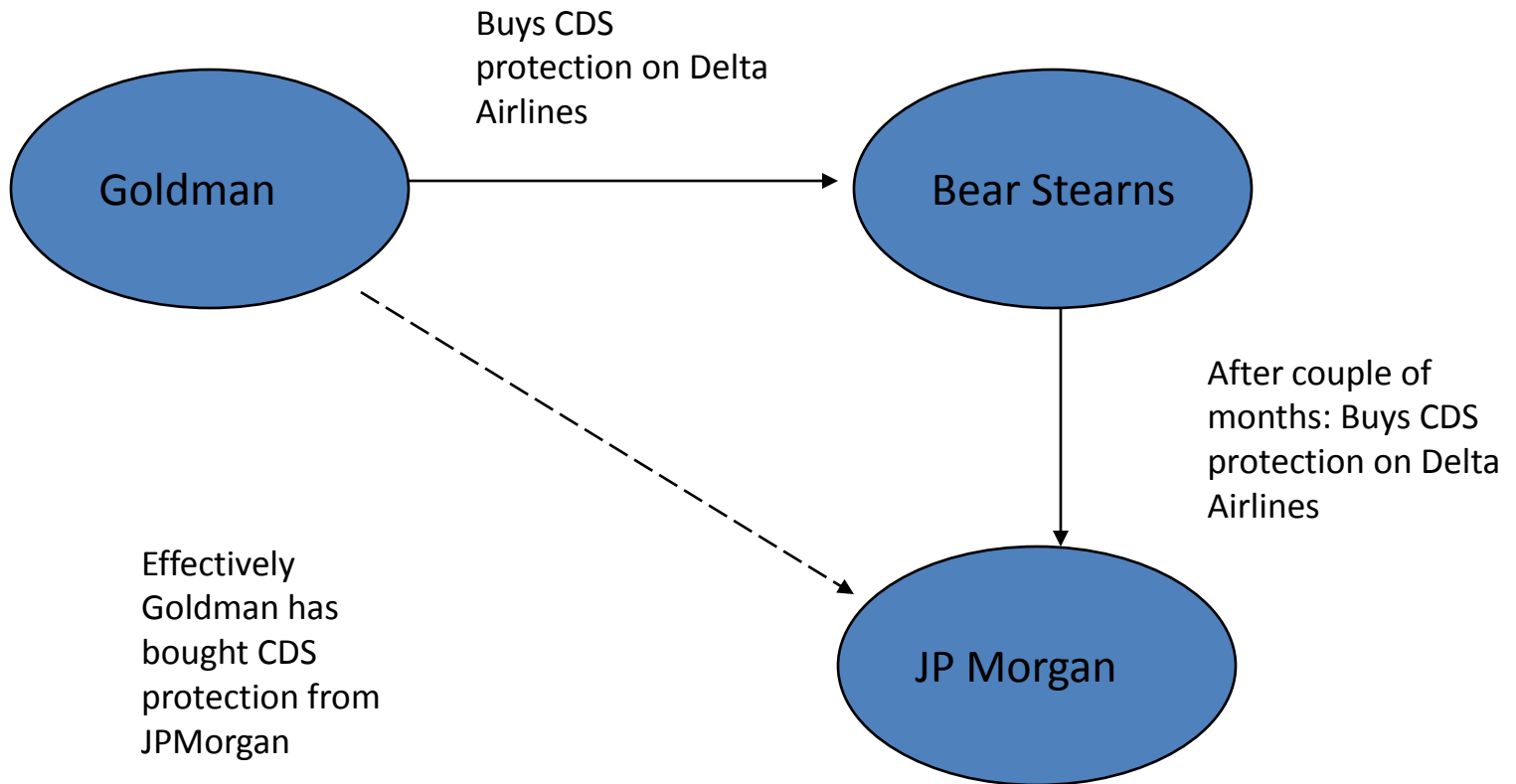




# Netting



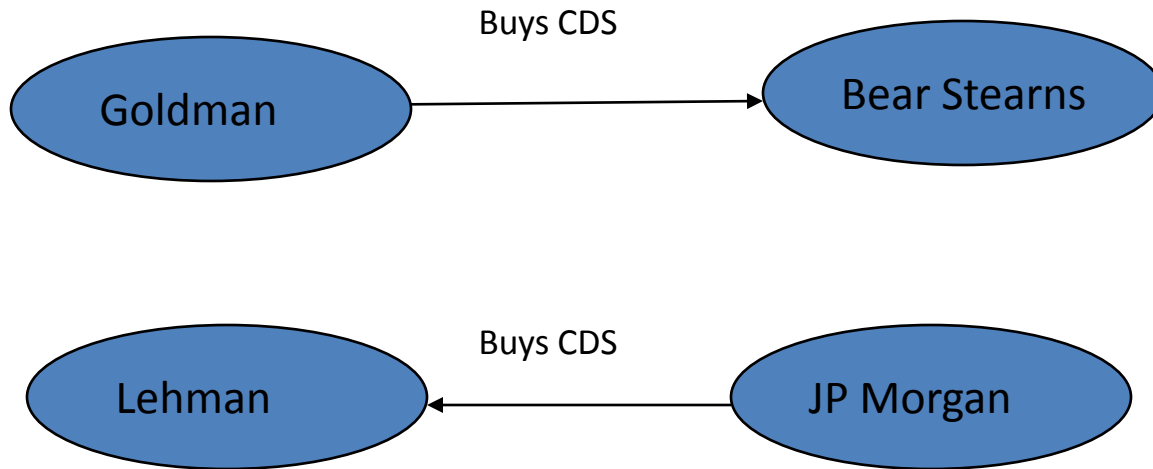
# Netting



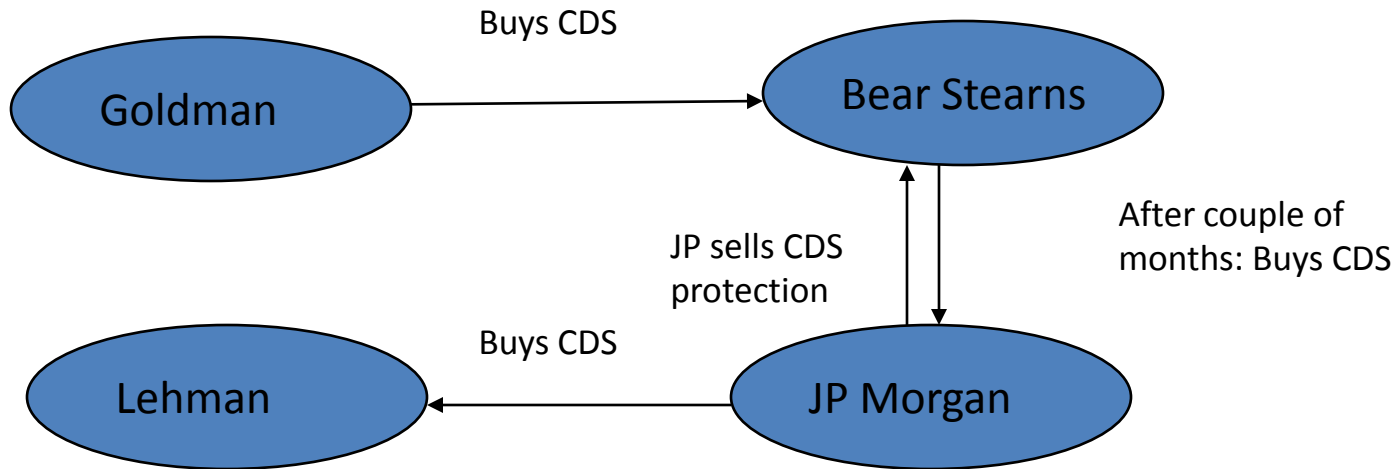
# What are the risks in this market?

- Network effects
  - CDS are bilateral contracts often sold and resold among parties
  - Buyers may not be as financially sound to cover the obligation in case of a credit event specially without collateral
  - In 2005 NY Fed advised that counterparties tell their trading partners when they've assigned the contract to others

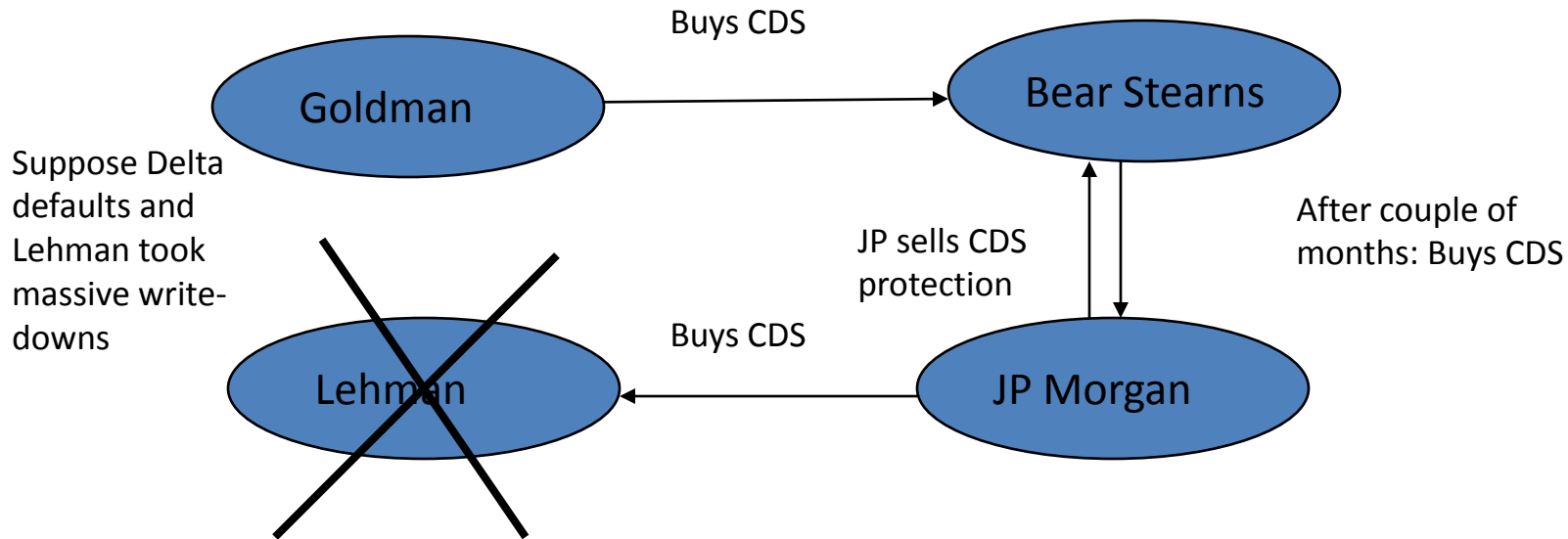
# Network (domino) effects



# Network (domino) effects



# Network (domino) effects



- Bear Stearns and JPMorgan could have stepped out
- Can lead to contagion and liquidity dry-ups

# What are the risks in this market (contd.)?

- Counterparty concentration risk
  - Risk that the counterparty will default and not pay what is owed under the contract
  - If a major counterparty like AIG fails, it leaves a large number of market participants un-hedged and exposed to losses
  - Can have a domino effect: can lead to mistrust and freeze up of market, systemic risk
- Hedging risk
  - Could hedge by selling short bond
  - If everyone does it together, it does not work
    - Similar to portfolio insurance in 1987
    - Cascading effect

# What are the risks in this market (contd.)?

- Collateral and margin spirals
  - Some “blue-chips” like “AAA” AIG and Lehman, were not required to post collateral
  - However, even with collateral
    - Asset values may be correlated with CDS protection sold and broader economy
    - Have to post more collateral
      - De-leveraging: selling assets at the worst time
    - Everyone does this together
      - Margin spiral
- Excessive speculation
  - Excess speculation without adequate collateral can cause contagion in case of credit event
  - Actual size of market (not notional) is estimated to be 10x size of underlying cash bond market
    - This should imply most bonds are cash settled since not enough bonds to settle physically.
    - Irony is single name CDS in US still states physical settlement on term sheets
      - Risk of squeeze on underlying bonds in case of credit event.
    - Though not certainty, this suggests speculation
      - Not actually hedging against bonds you own



# Quantifying risks

- Actual size of market (not notional) is estimated to be 10x size of underlying cash bond market
- Modeling is hard:
  - Illiquid
  - True default probabilities hard to judge
  - Default correlations very hard to judge making it difficult to aggregate risks
  - Asymmetric, Fat-tailed (left-skew) distribution makes it even harder to model

# Example: Lehman

- September 15, 2008 bankruptcy resulting from its investments in subprime mortgages.
- “Event of Default” – CDS where Lehman was the counterparty – special trading session on September 14.
- “Credit Event” – CDS where Lehman was the reference party – approximately **\$400 billion** in CDS contracts.

# Lehman – Auction

- Auction: Allows cash settlement when the notional amount of CDS on a reference entity is in excess of its outstanding debt.
  - Avoids valuation disagreements and need for market polls.
  - Mitigates risk of outstanding debt trading up due to artificial scarcity. Delphi, 2005, had \$2.2 billion in bonds, \$28 billion in credit derivatives outstanding. The debt traded up from 57 cents on the dollar to a high of 71 cents before falling back to 60 cents
- Lehman Auction on October 10 to determine the value of Lehman bonds: 8.625 cents on the dollar. Sellers of protection needed to pay out 91.375 cents for every dollar of insurance sold.
- Ultimately, the auction settled with a net payout of \$5.2 billion.

# Lehman Bankruptcy – Other Effects

- Commercial paper market
  - First time in 14 years that a money market fund had “broken the buck.”
- CDS market: Average cost of 5-year insurance on \$10 million debt increased from \$152,000 the previous Friday to \$194,000 (CDX Index).
  - Sellers of insurance had to post extra collateral: \$140 billion in market calls.

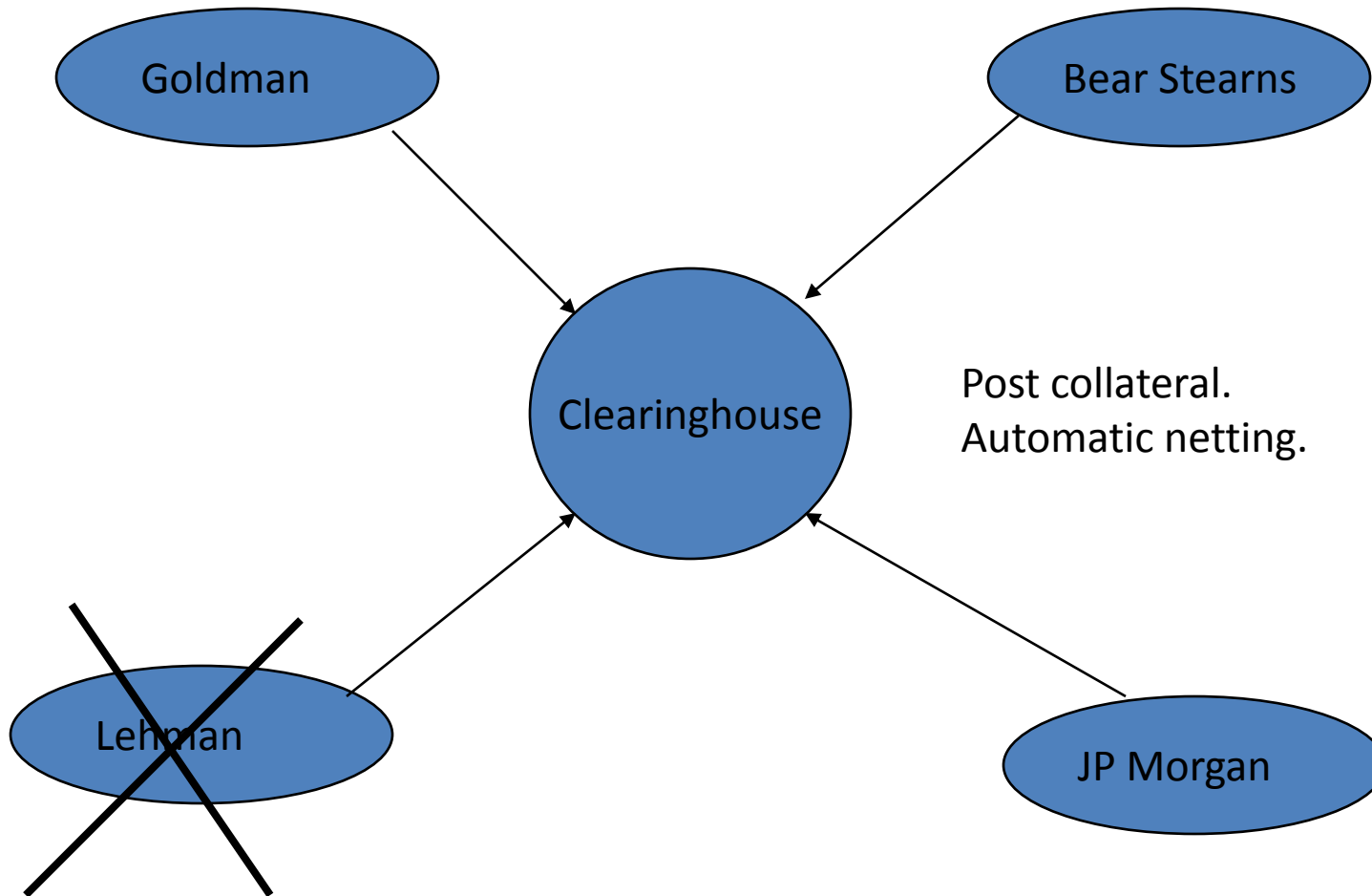
# Examples: AIG

- AIG sold \$447 billion in un-hedged, relatively under-margined (i.e. no collateral) (due to AAA credit) CDS coverage
- In 2005 and early 2006, head of the financial products unit, Joe Cassano pushed AIG into writing protection on AAA portion of CDO's
  - Models stated very low default probability
  - High fees without posting collateral
- As write-downs grew, starting summer of 2007, the counterparties demanded collateral.
  - Started off write-downs (as asset prices lowered) and further margin calls.
  - Eventually margin calls rose to \$50 billion by September when AIG was downgraded to single-A and had to seek government bailout because it did not have the short-term liquidity to meet margin calls
- Aside: cash collateral left by traders and hedge funds was used to invest in sub-prime and Alt-A mortgage paper. As they crashed in value, and as the traders returned stock, AIG could not give the collateral back.
- Classic margin, loss spiral we talked about in class

# What is the solution in light of this?

- Clearinghouse to reduce counterparty credit risk:
  - The idea of the clearing house like clearing house for futures
  - Collateral is continuously posted in the form of margin, to cover the drop in market value according to CDS spreads widening or narrowing.
    - AIG allowed to sell protection without posting collateral.
  - Automatic netting
    - Avoids domino effect outlined before
  - Clearinghouse effectively guarantees payment in a default event, avoids the contagion of non-payments and spiraling margin calls.
  - Will also illuminate size of the effective exposure of the counterparty to the clearinghouse.
  - A clearinghouse also provides enhanced liquidity and price discovery through standardization and centralized trading.

# What is the solution in light of this?



# Current state of clearinghouse

- As of Nov 12., the Fed wants to be the regulator for clearing trades.
- Two competing platforms:
  - The CME (Chicago Mercantile Exchange):
    - Entered into joint venture with Citadel
    - They are waiting for regulatory approval to begin clearing CDS trades.
  - The ICE (Intercontinental Exchange) is also competing. It has bought Clearing Corp. a company which specializes in clearing trades.
    - Has a trade clearing platform (“Concerto”) and is owned partly by some of the major dealers like Goldman Sachs, Deutsche Bank, Morgan Stanley etc.



# Ending thoughts

*As we know, there are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns—the ones we don't know we don't know. (Donald Rumsfeld, US dept of defense 2002)*

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