

CREDIT DERIVATIVES WORKSHOP

The complete webcast is available [here](#).

High Grade Strategy and Credit Derivatives Research

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Agenda

■ Module 1: Overview

- **CDS market overview and update on new market regulations**

■ Module 2: CDS basics and pricing

- CDS fundamentals: how contracts work, trading and valuation
- CDS pricing in more details

■ Module 3: Relative value trading

- CDS vs bonds
- CDS curves

■ Module 4: Index products

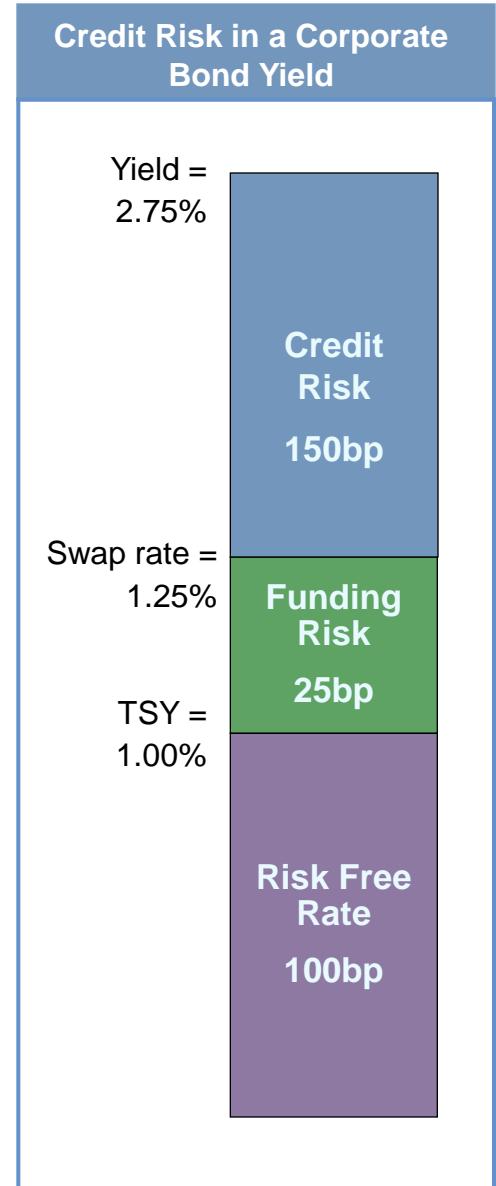
- CDX indices and iBoxx TRS
- Index options and Index tranches

CDS Market Overview

- What are Credit Derivatives?
- Why do investors use CDS?
- Market size and market activity
- Infrastructure, trading formats, and regulations

Credit Spread as Default Compensation

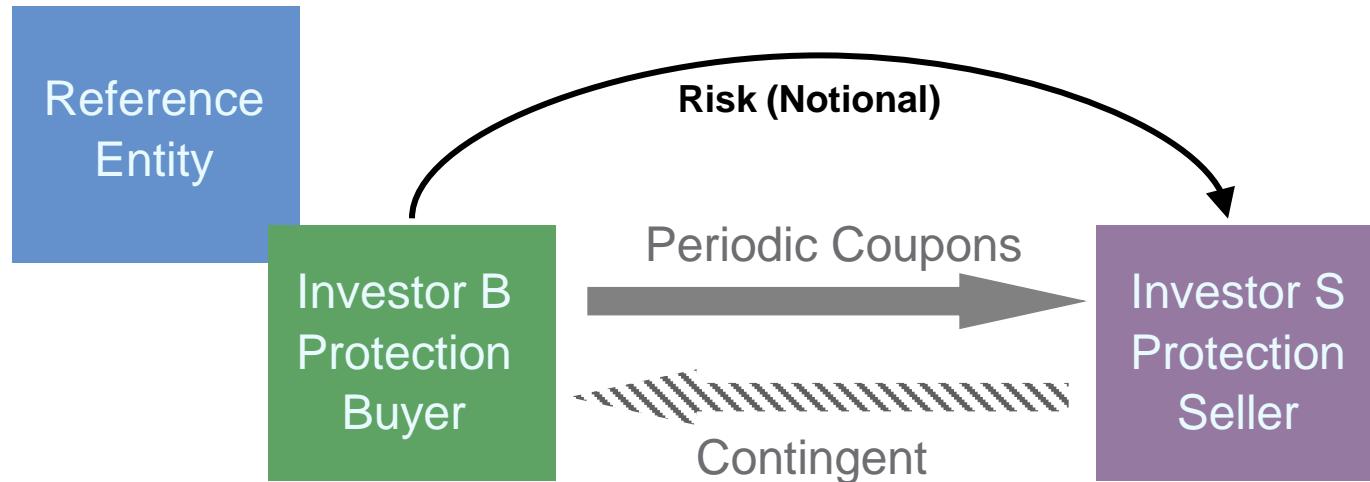
- Credit spread on a corporate bond: additional return earned above the ‘risk-free’ rate, compensates for exposure to corporate risk
- Corporate risk is risk of default or deterioration in credit-worthiness
- Bond all-in yield can be decomposed into three parts:
 - 3) Credit risk – Credit spread
 - 2) Funding risk – Swap spread
 - 1) Risk-free rate – Treasury rate
- CDS focuses on credit risk only



Source: J.P. Morgan

Investors Buy and Sell Credit Risk Using CDS

Buying CDS can be compared to purchasing credit insurance on a company



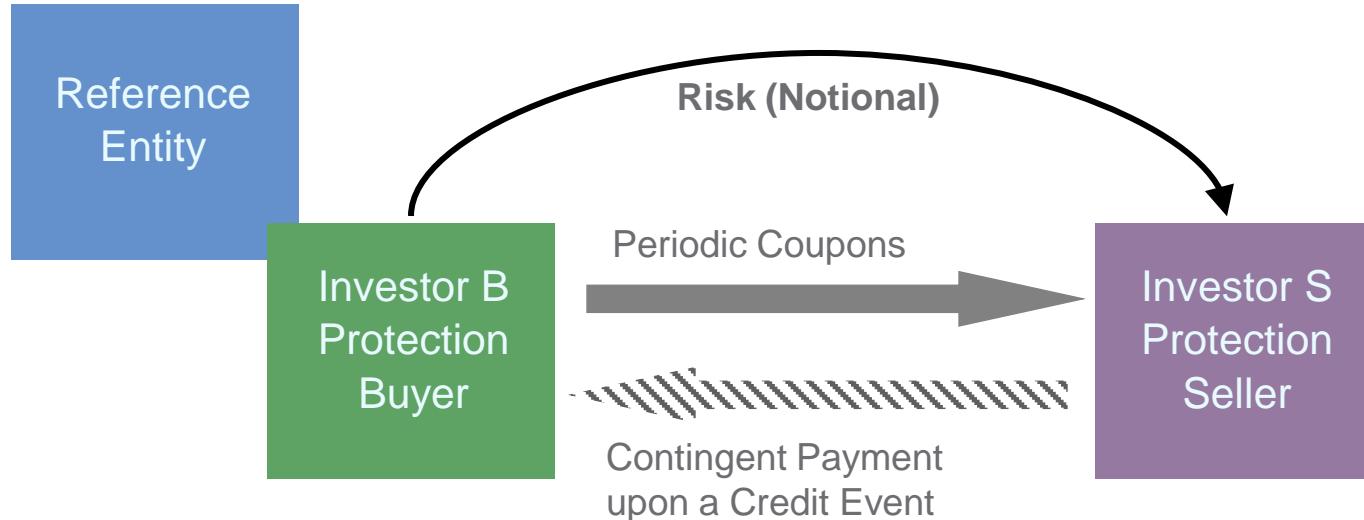
- “Short risk”
- Buy default protection
- Buy CDS
- Pay Periodic Payments

- “Long risk”
- Sell default protection
- Sell CDS
- Receive Periodic Payments

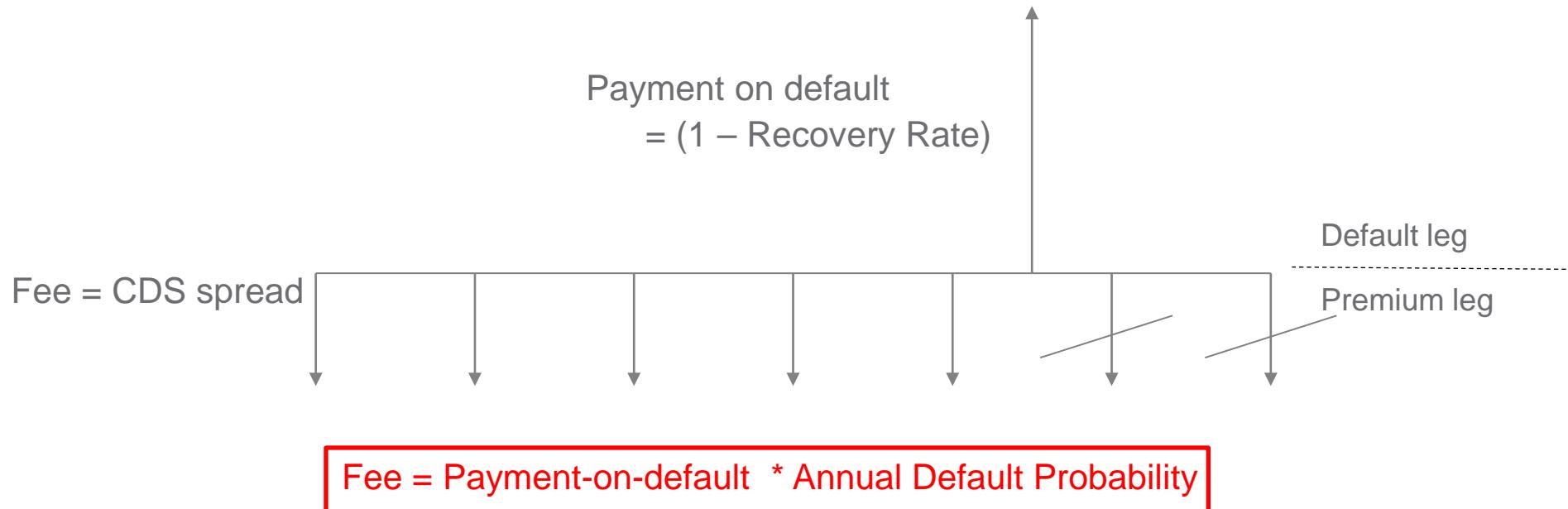
Credit Risk Profile of shorting a bond

Credit Risk Profile of owning a bond

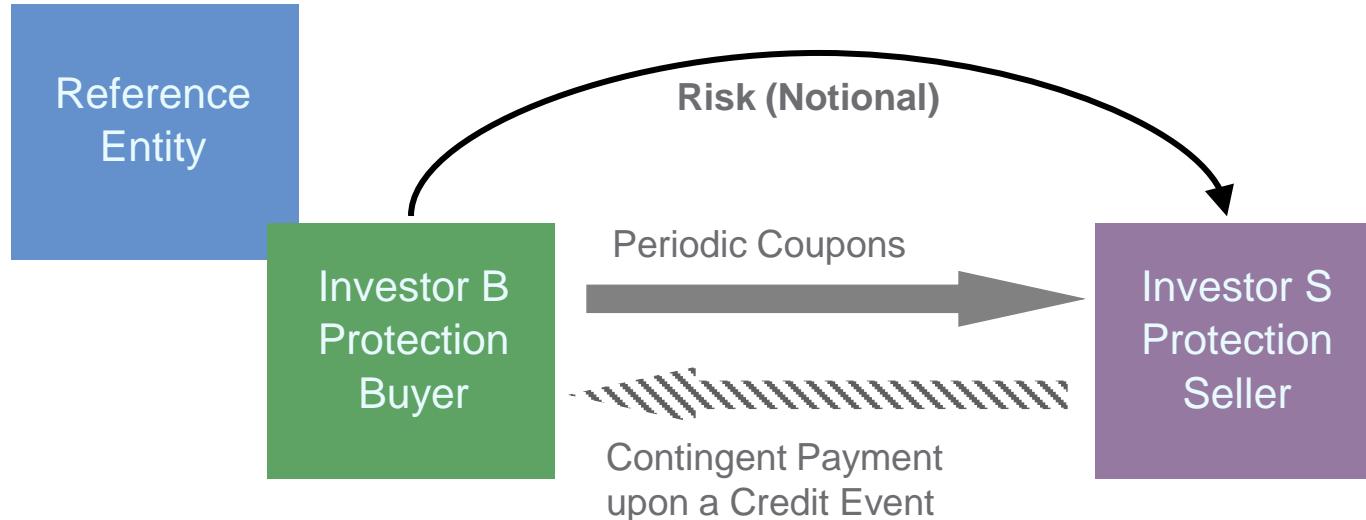
Single-Name CDS: Cash Flows



Cash flows for Investor B, the protection buyer



Single-Name CDS: Recovery and Pricing



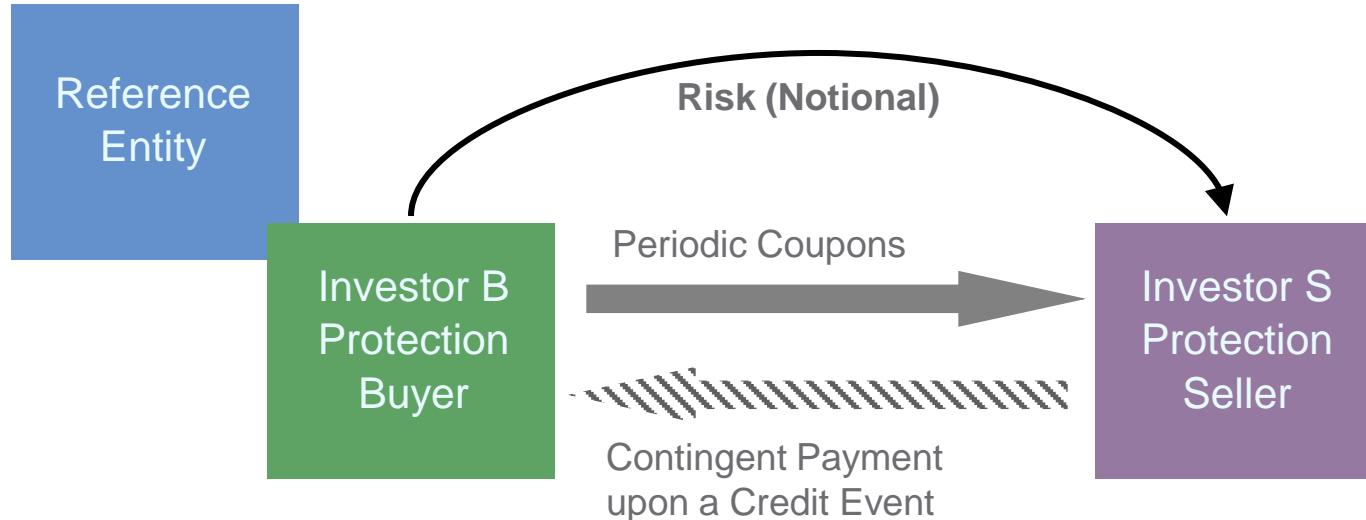
Recovery rate and pricing

- Recovery rate is such that an investor who buys a bond (\$100 face value) and buys \$100 notional CDS protection on that bond's issuer is made whole in case of a credit event
- Pricing principle: “What you expect to pay is what you expect to get”
 - Spread = $(1 - \text{Recovery Rate}) * \text{Annual Default Probability}$
 - Example: 300bp if 40% recovery rate and 5% annual default probability
 - However, also 300bp if 90% recovery rate and 30% annual default prob.

Credit Events Trigger “Insurance Payment”

- Two credit events for corporate CDS SNAC contracts (in US)
 - Filing for **bankruptcy** (or if the company becomes subject to the appointment of an administrator, conservator, trustee, or custodian, even if there is no bankruptcy filing)
 - **Failure to pay** principal or coupon on any bond or loan issued by the company, or guaranteed by the company (and the company has 50%+ ownership)
- One more credit event for Europe: **Restructuring** (MMR contracts)
 - A restructuring event is triggered if, because of financial distress, a bond's maturity is extended or principal or coupon is reduced, and such a change is binding to all holders
 - Most exchange offers do not trigger Restructuring because the exchange is voluntary

Single-Name CDS: Recovery and Pricing



Recovery rate and pricing

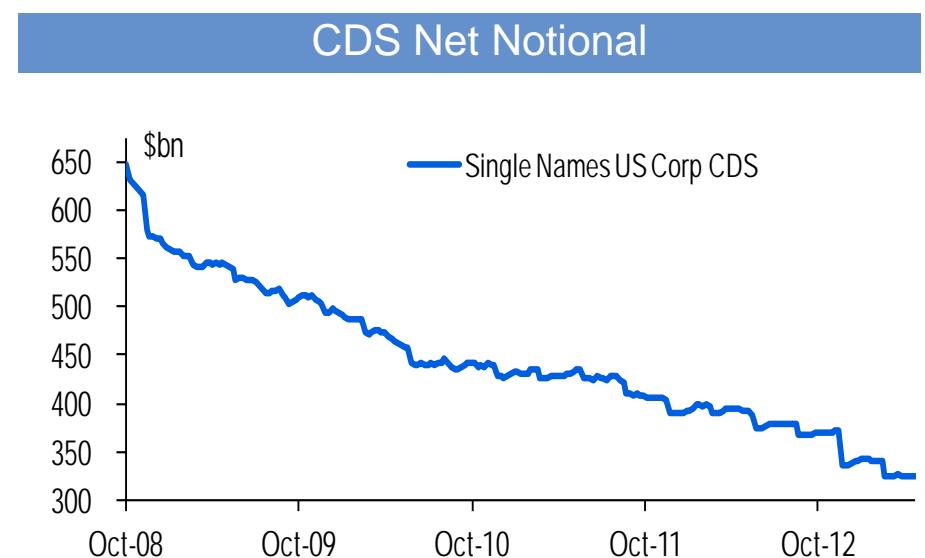
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Credit Events Trigger “Insurance Payment” – Cont.

- Three credit events for Sovereign CDS
 - Failure to pay
 - Restructuring (non-voluntary)
 - Repudiation / Moratorium
- Example Greece CDS
 - Feb 24 and Feb 29, 2012: ECB and NCB status as creditors and the inclusion of Collective Action Clauses (CACs); CDS not triggered
 - March 9, 2012 : Exercise of CACs; CDS triggered
- There are also **Succession Events** in CDS which might lead to one single-name CDS splitting and pointing to different companies (e.g. after a spin-off, like for Verizon Comm. to Verizon Comm. and Idearc Inc). Note that a Succession Event does not trigger the CDS and a payment by the protection seller.

Market Size and Market Activity

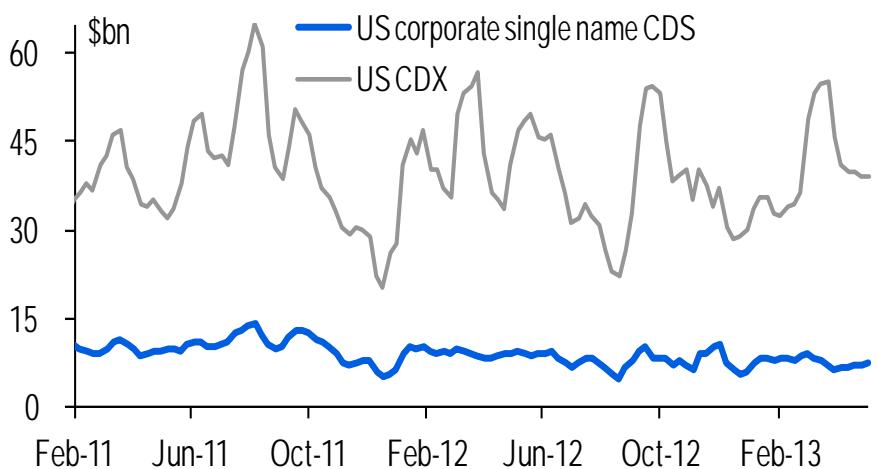
- CDS risk outstanding: smaller than risk in corporate bonds
- CDS much more liquid than any bond of a specific issuer
 - IBM most traded bond: \$8mn/day; IBM CDS: \$31mn/day
 - Typical notional size: \$5-20mn in HG and \$2-10mn in HY
 - 5y maturity is the most liquid



Risk and trading volume: US HG

	Net notional (\$bn)	Avg Daily Trading Volumes (\$bn)
HG US bonds	4,700	13
US HG CDS	240	5
CDX.IG	340	31

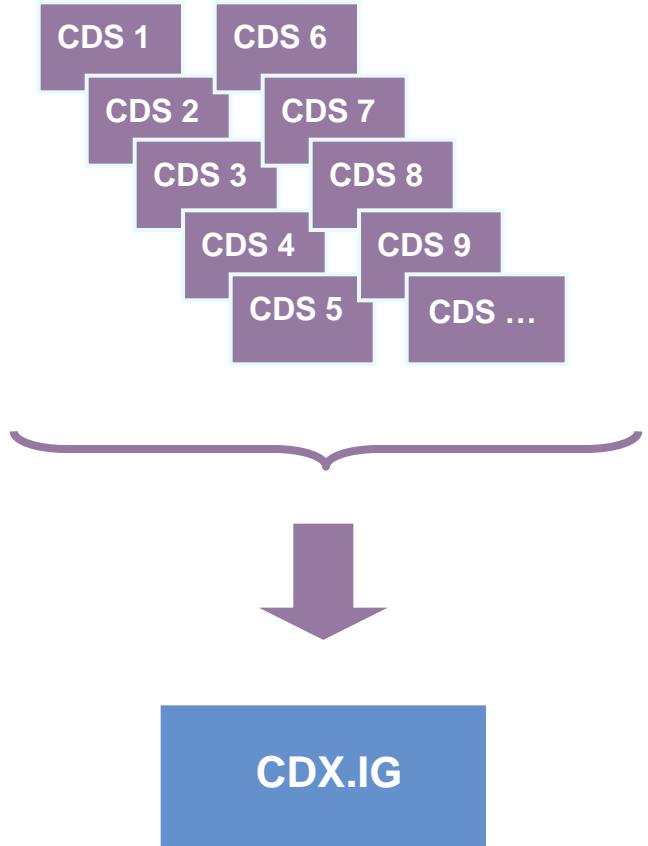
Average Daily Trading Volumes



Source: DTCC and J.P. Morgan, as of 5/31/13, averages over last 6 months

CDS Indices: THE Most Liquid Credit Instruments

- Standalone contract to gain credit exposure to a broad portfolio of firms at once
- Fixed maturity and fixed portfolio
- Same default exposure as buying/selling CDS on each underlying firm
- Generally “equally” weighted: exposure to each company is the same
- Index price fluctuations related to price fluctuations of the underlying single-name CDS, but there can be divergences
- New “on-the-run” indices launched every 6 months, with new maturity date and slightly modified portfolio of underlying credits to include most liquid CDS



Credit Derivative Indices Across the World

US Indices

- CDX.NA.IG
- CDX.NA.HY
- LCDX
- MCDX

European Indices

- iTraxx Main + Sub Indices
- iTraxx HiVol
- iTraxx Crossover (High Yield)
- SovX West Eur

Asia Indices

- iTraxx Japan + Sub Indices
- iTraxx Asia ex-Japan + Sub Indices
- iTraxx Australia
- SovX Asia/Pac

Emerging Markets Indices

- CDX.EM
- SovX CEEMEA
- CDX LatAm Corp

Infrastructure, Trading Formats and Regulations

- Trading format and infrastructure
- CDS credit event settlement
- Changes since the crisis
 - Fixed coupon and upfront
 - Determination committee
 - Hard-wired auction
 - Effective date
- Dodd-Frank implementation
 - Clearinghouse
 - Exchange / Swap Execution Facility (SEF)
 - Post-trade transparency

Trading Format and Infrastructure

- CDS trade with fixed coupons and upfronts
 - CDS trade like bonds w/ either 100bp or 500bp coupon in the US
 - Note that other coupons are also available in EU: 25bp, 50bp and 1000bp
 - Upfront is like discount (if positive) or premium (if negative) on a bond
 - If spread larger than coupon, CDS upfront is positive
- Effective date: 60-day rolling lookback period for credit events (90 days for succession events)
- CDS/CDX can be settled in cash or physical (i.e. by trading bonds)
- CDS Auction settlement is hardwired

Why is there an upfront and how large is it?

- Assume 3y CDS market spread is 180bp
- For a 100bp contract, upfront is 2.3%
- Before fixed coupons were established you would pay nothing upfront and 180bp/year to buy the 3yr protection
- If trading with a fixed coupon of 100bp you are paying 100bp/year, so too little each year. Therefore, you need to pay an upfront amount to make up for this
- \$2.3 is present value of the 80bp you are not paying each year on your \$100 protection ($80\text{bp} = 180\text{bp} - 100\text{bp coupon}$); therefore, protection buyer pays 2.3% upfront

	180bp coupon	100bp coupon
Today	0	\$2.3
Year 1	\$1.8	\$1.0
Year 2	\$1.8	\$1.0
Year 3	\$1.8	\$1.0
Total paid	\$5.4	\$5.3
PV of total paid	\$5.1	\$5.1

Trading Format and Infrastructure – Cont.

- Determination Committee
 - To ensure a uniform contract with consistent determinations
 - Decides whether Credit Event has occurred, whether a particular bond or loan is deliverable, and whether Succession Event has occurred
 - Dispute resolution mechanism to ensure a decision is reached
 - 15 members: 8 global dealers, 5 buy-side members and 2 regional dealers
- Decisions and Votes
 - All member votes are made public and published on the ISDA website
 - Votes on both Greece CDS default questions were unanimous
 - More than 900 decisions taken by the DC in the last three years, with around 96% of them decided unanimously
 - For a sample of decisions, ISDA estimates that average DC deliberation time was one day and the average time between the date DC was asked the question and the CDS auction date was 38 calendar days in the Americas

CDS Default Settlement: In Cash or by Trading Bonds

- The protection buyer and seller both have the choice to cash settle or to physically trade bonds
- Deliverable obligations: most CDS contracts point to the senior unsecured level of the capital structure. Any bond that is pari passu or better can be delivered. Also, a bond that is guaranteed by the company can be delivered as long as the company owns more than 50% of the issuing entity.
- CDS contracts are settled through an auction process (a few weeks after the credit event). All investors settle at same recovery rate, determined in the auction.
- Example: CDS auction recovery rate = \$20
 - Cash settlement: $\$100 - \$20 = \$80$ paid by protection seller to protection buyer
 - Physical settlement: protection buyer delivers a bond to protection seller and receives \$100 from protection seller

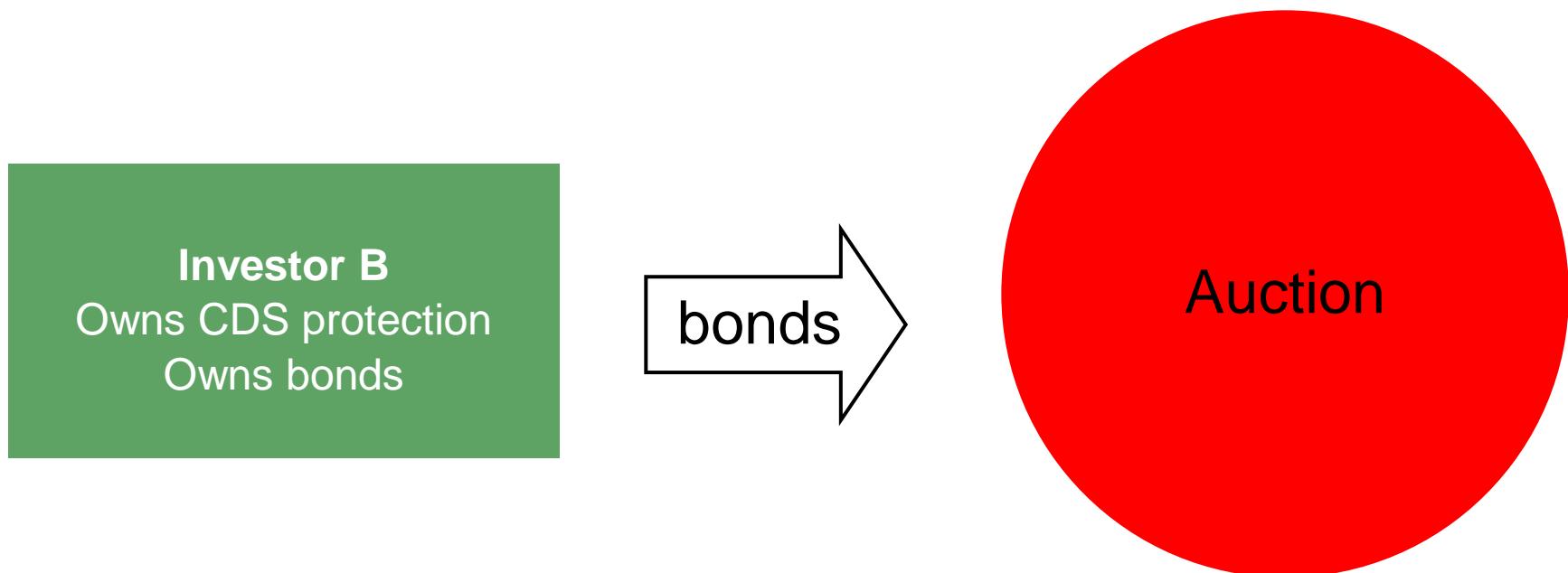
CDS Settlement: Auction Process

- The auction allows investors to:
 - Determine a Recovery Rate
 - Cash or physically settle CDS contracts using this rate
- Single-name CDS, CDX, CDX tranches, bespoke portfolios, and other contracts can all be settled through the protocol
- The auction process is part of the standard CDS contract

If There Was Not an Auction...

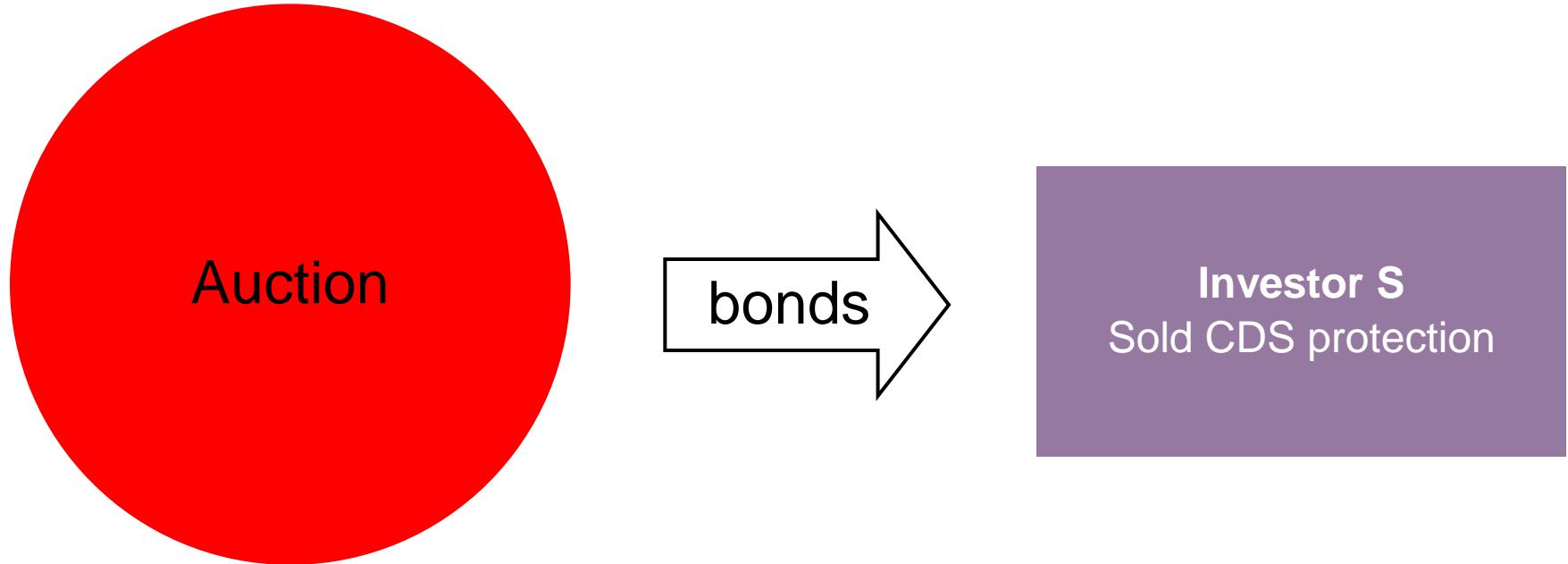
- CDS is a “closed system.” For every protection buyer there is a seller. Assume \$100mm CDS notional outstanding.
- If all investors physically settled, settlement is straightforward
 - Protection buyers (short risk investors) deliver \$100mm of bonds to protection sellers in return for par (assuming there were \$100mm bonds available)
- If all investors cash settled, settlement is also straightforward
 - If investors agree on a recovery rate for the bond, protection sellers (long risk investors) pay (1-Recovery Rate %) to the buyers
- The auction allows each investor to choose physical or cash settlement
 - This creates a mismatch, which is resolved through the process
 - Auction takes place in two stages

“Open Interest” is the mismatch created by different numbers of cash and physical settlement requests



- Investor B wishes to physically settle and deliver his bonds into the auction
- These bonds therefore need to be sold so they create open interest to **sell** bonds

Long risk physical settlement requests create “buy” Open Interest



- Investor S wishes to physically settle and receive bonds through the auction
- Creates open interest to **buy** bonds

Part 1 of the Auction: Open Interest and Starting Price

- In the Lehman Brothers auction, the physical settlement requests were:

Sell requests: \$5.7bn

Buy requests: \$0.8bn

Open interest: \$4.9bn to sell bonds

- In the Lehman Brothers auction, 14 dealers submitted \$10mm by \$10mm, \$2 wide markets
- Tradable or “touching” markets are ignored, the remaining best bids/asks are averaged (and rounded to 1/8)
- Initial recovery rate = \$9.75 for \$100 face value

Auction: 1st round			
Dealer	Bid	Offer	Dealer
HSBC	\$10.00	\$10.00	Barclays
Banc of America	\$9.50	\$10.00	Credit Suisse
Dresdner Bank	\$9.50	\$10.00	Deutsche Bank
Citigroup	\$9.25	\$10.00	Merrill Lynch
Royal Bank of Scotland	\$9.25	\$10.25	Morgan Stanley
BNP Paribas	\$9.00	\$10.75	UBS Securities
JPMorgan Chase	\$9.00	\$10.88	Goldman Sachs & Co
Goldman Sachs & Co	\$8.88	\$11.00	BNP Paribas
UBS Securities	\$8.75	\$11.00	JPMorgan Chase Bank
Morgan Stanley	\$8.25	\$11.25	Citigroup
Barclays	\$8.00	\$11.25	Royal Bank of Scotland
Credit Suisse	\$8.00	\$11.50	Banc of America
Deutsche Bank AG	\$8.00	\$11.50	Dresdner Bank
Merrill Lynch	\$8.00	\$12.00	HSBC

Source: Creditex Group Inc. and Markit Group Limited

Part 2 of the Auction: Final Recovery Rate

- Dutch Auction to fill physical settlement imbalance = Final Recovery Rate
- Any investor can submit limit orders to fill the open interest
- The final recovery rate is used for cash settlement

**Final Recovery Rate
= 8.625%**

Price	Buy limit order size (\$mm)	Cumulative buy orders
\$10.750	\$250	\$250
\$10.250	\$670	\$920
\$10.000	\$5	\$925
\$9.875	\$5	\$930
\$9.750	\$1,730	\$2,660
\$9.625	\$5	\$2,665
\$9.500	\$60	\$2,725
\$9.375	\$15	\$2,740
\$9.250	\$30	\$2,770
\$9.125	\$520	\$3,290
\$9.000	\$617	\$3,907
\$8.875	\$25	\$3,932
\$8.750	\$605	\$4,537
\$8.625	\$520	\$5,057
\$8.500	\$820	\$5,877
\$8.375	\$525	\$6,402
\$8.250 and lower	\$125,924	\$132,326

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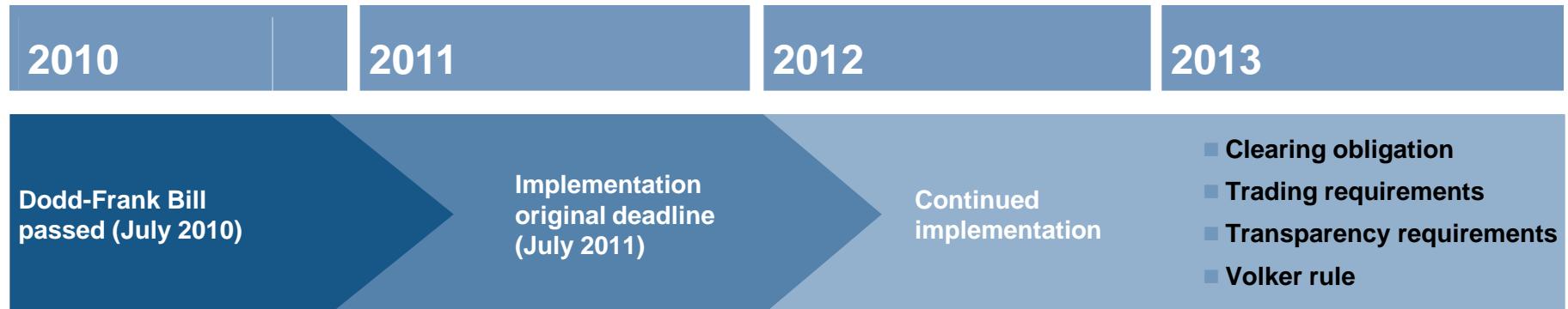
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US timeline of implementation of clearing and trading obligations



Source: www.sec.gov and J.P. Morgan

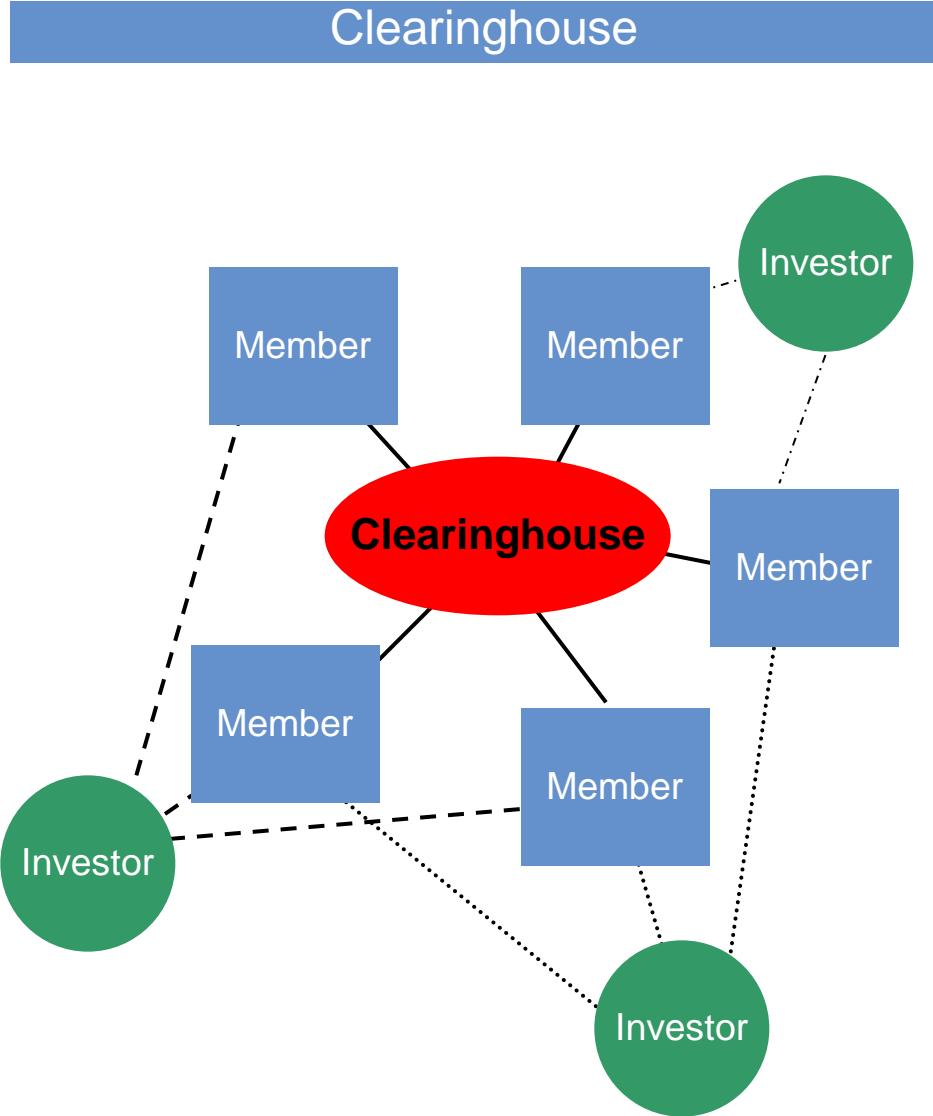
- Dodd-Frank bill (passed on July 15, 2010) significantly affects CDS markets
- Greatest impact to CDS markets
 1. Most CDS contracts must be cleared by a central counterparty
 2. Many CDS must be traded on an exchange or on a Swap Execution Facility (SEF)
 3. Post-trade transparency (real time for most trades)
- Changes were originally scheduled to take effect in July 2011, but there were delays
- Implementation has already started for some aspects and some investors (e.g., clearing for CDX/iTraxx indices) or is about to start (e.g., CDX/iTraxx indices to trade on SEFs)
- Bill goal: a more transparent CDS market with less counterparty risk. If these goals are achieved, it will be a positive development for all market participants.

Regulatory changes to impact CDS markets in 2013

- The CFTC has published final rules for CDX/iTraxx trading
 - Clearing started in March 2013 (first phase)
 - SEF trading will start in October 2013 (first phase). SEFs are many-to-many electronic platforms.
- The first phase is for the more active market participants (i.e., swap dealers, major swap participants and active funds). Other market participants will follow suit throughout 2013-14.
 - For the CDS index markets, the first products required to be cleared will be specified tenors and series of CDS indices (i.e., CDX.IG, CDX.HY, iTraxx Main, iTraxx HiVol and iTraxx Xover).
 - Later in 2013, the SEC will likely publish a list of single-name CDS that will be subject to mandatory clearing
- CDX block trades for SEFs: At the moment, for CDX/iTraxx, the block size trade for the 5y on-the-run indices is \$110mn if they trade tighter than 175bp, \$32mn if they trade between 175bp and 350bp, and \$26mn if they trade wider than 350bp.
- The CDX cap size for reporting is \$100mn (i.e. a \$200mn trade will be reported as \$100mn+).
- Finally, please note this discussion reflects our current understanding of the CFTC's and SEC's regulations and it should not be considered a legal opinion. Investors should consult with their legal advisors regarding how applicable laws may affect their investing activities.

Clearinghouse

- To reduce counterparty risk
- What the clearinghouse does:
 - Members face clearinghouse rather than one another
 - Set initial and maintenance margin for each member
 - If a member defaults, clearinghouse uses margin accounts, plus additional resources (guarantee funds)
- For non-members (clients):
 - Easier to assign their trades from one member to another, even if their original dealer is under stress



CDS Market Overview: Summary

- CDS allow investors to take corporate credit risk
- CDS are more liquid than bonds
 - Liquidity concentrated on the 5Y maturity
 - CDX indices are the most liquid credit instruments
- CDS risk outstanding is similar to the outstanding risk in bond
- Credit crisis has brought significant changes
 - Some already implemented: Big Bang
 - Some being implemented: Dodd-Frank

10 MINUTE BREAK

Refreshments outside

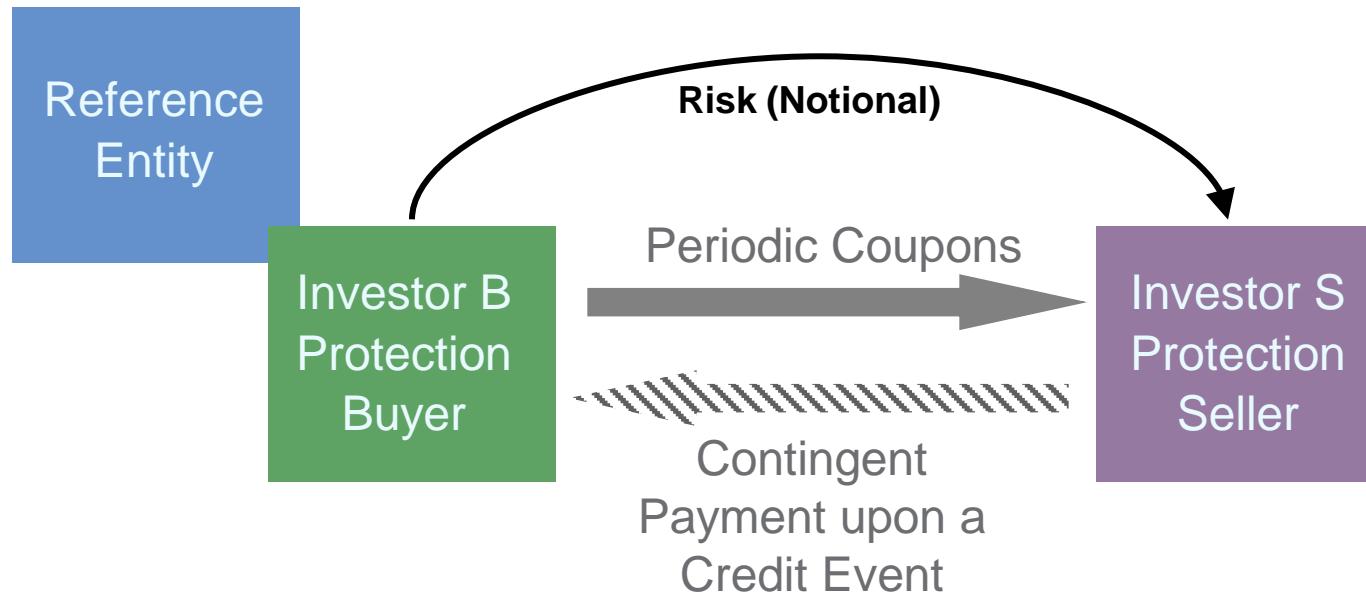
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CDS Fundamentals

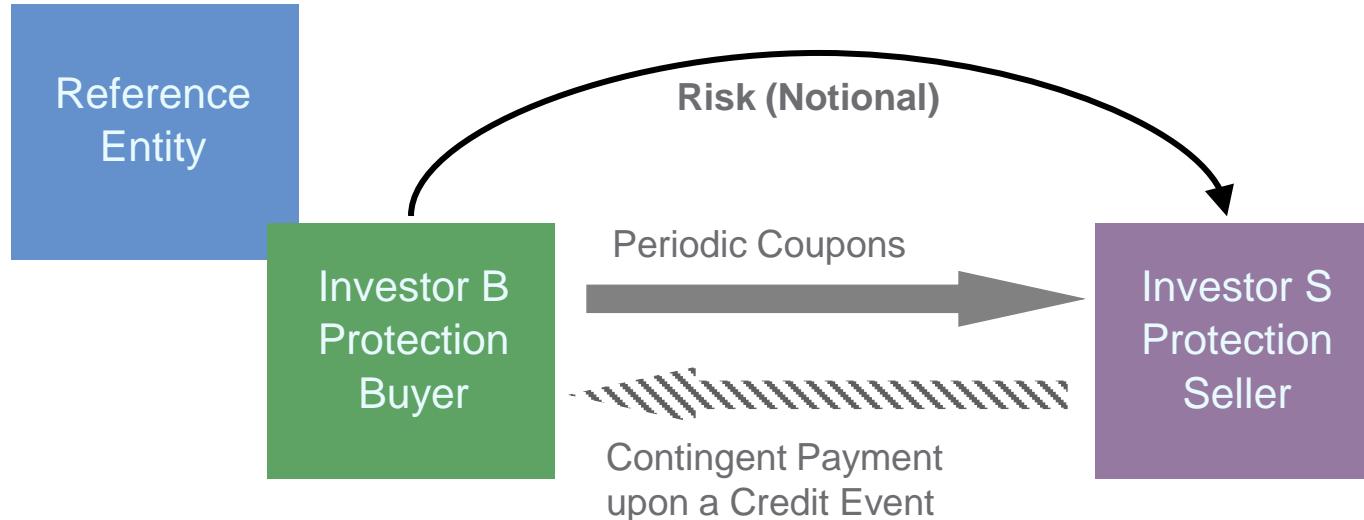
- CDS mechanics
- Mark to market
- Default probability
- From par spread to upfront + fixed coupon
- Examples

Investors Buy and Sell Credit Risk using CDS

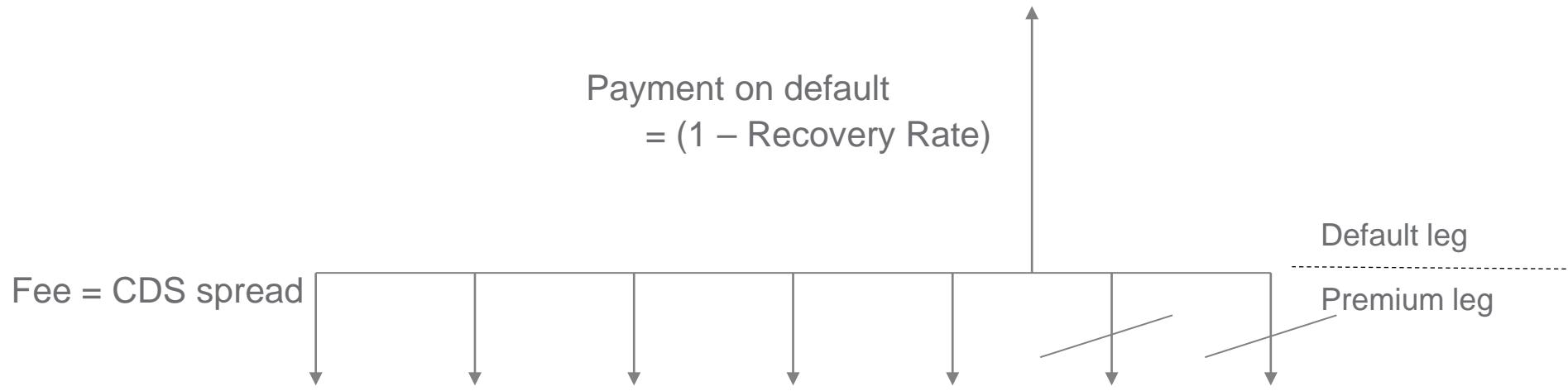


- A Credit Default Swap is similar to a credit insurance contract: protection buyer transfers risk that reference entity might default
- In return for the protection, the protection buyer pays a protection fee to the protection seller (quarterly)
- If a credit event occurs, protection buyer delivers a defaulted obligation of the reference entity, and receives par (or settles a net cash amount)

Single-Name CDS: Cash Flows

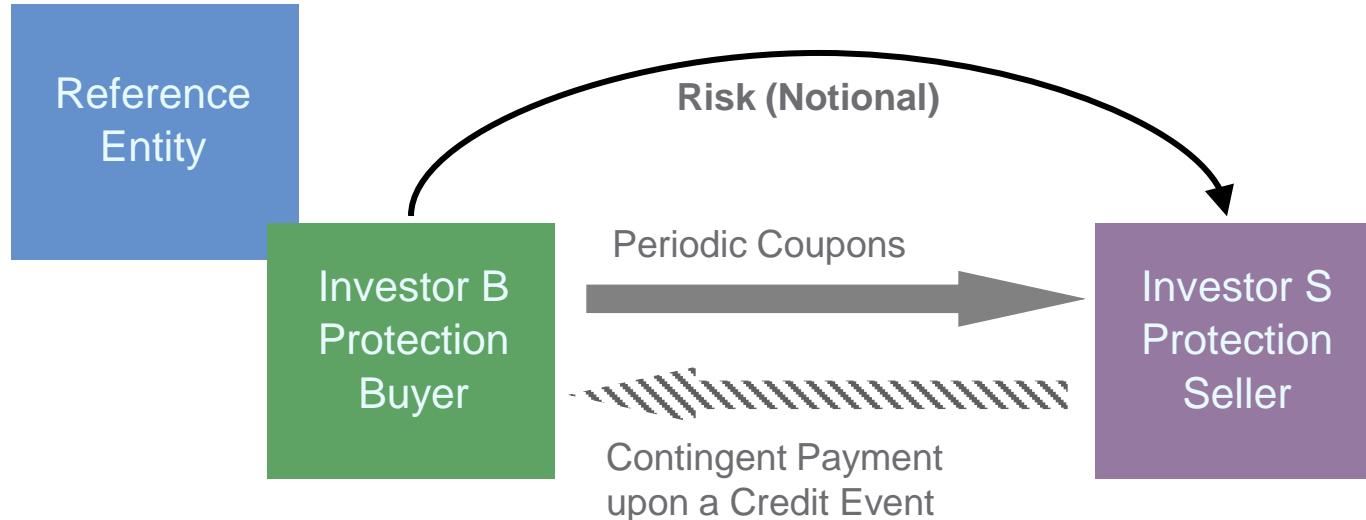


Cash flows for Investor B, the protection buyer



$$\text{Fee} = \text{Payment-on-default} * \text{Annual Default Probability}$$

Single-Name CDS: Recovery and Pricing



Recovery rate and pricing

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- Pricing principle: “What you expect to pay is what you expect to get”
 - Spread = $(1 - \text{Recovery Rate}) * \text{Annual Default Probability}$
 - Example: 300bp if 40% recovery rate and 5% annual default probability
 - However, also 300bp if 90% recovery rate and 30% annual default prob.

Four Parameters Uniquely Define a Credit Default Swap

- **Which Credit** (Note: Not which bond, but which company)
 - Credit default swap contracts specify a reference obligation that
 - (1) robustly defines the issuing entity through the bond prospectus and
 - (2) indicates what level of the capital structure is delivered in default (typically senior unsecured bond, but can be secured bonds or preferred stock)
- **Notional Amount**
 - Amount of credit risk being transferred
 - Agreed between the buyer and seller of CDS protection
- **Spread** (or Upfront / Price)
 - No matter the quoting convention, two cash flows are agreed on: (1) the upfront amount and (2) the annual fixed coupon (100bp or 500bp), where payments are paid quarterly, and accrue on an Actual/360 day basis
- **Maturity**
 - The expiration of the contract, usually on the 20th of March, June, September or December. Generally, the 5-year contract is the most liquid.

Example: Buying Protection (Short Risk) on FedEx

Trade 1: Today, morning

Investor B: Buy CDS protection
(short credit risk, pay spread)

Credit: FedEx

Notional: \$10mm

Spread: 110bp

Maturity: 5 years (6/20/2018)

- If Investor B believes FedEx creditworthiness will worsen, she would buy CDS protection (short credit risk), paying 110bp annually, in our example
- If spreads on FedEx increase (>110bp): Investor B (protection buyer) makes money
- If spreads on FedEx decrease (<110bp): Investor B (protection buyer) loses money

Investor B
Protection Buyer
(Short credit risk)



Investor S
Protection Seller
(Long credit risk)

If FedEx's Credit Worsens: Monetize Gains by Entering into Opposite Trade

- Assume that by the evening, FedEx's spread widened by 140bp
- Investor B could enter into an opposite trade, namely sell CDS (long risk) and receive 250bp annually. She continues to pay 110bp annually, thus nets 140bp per year through 2018
- There is default risk in that, if FedEx defaults, investor B will stop receiving the annual net 140bp. Otherwise, she is default neutral.

Trade 2: Today, evening

Investor B: Sell CDS protection
(long credit risk)

Credit: FedEx

Notional: \$10mm

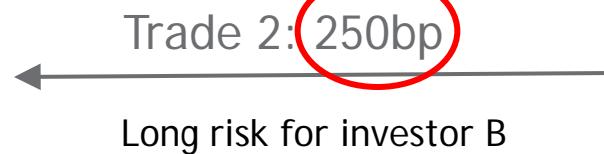
Spread: 250bp

Maturity: 5 yrs (6/20/2018)

Investor B
Protection Buyer
(Short credit risk)

Investor S
Protection Seller
(Long credit risk)

Investor B2
Protection Buyer
(Short credit risk)



If FedEx's credit worsens, monetize gains by entering into opposite trade

Trade 1: Today, morning

Investor B: Buy CDS protection
(short credit risk)

Credit: FedEx

Notional: \$10mm

Spread: 110bp

Maturity: 5 years (6/20/2018)

Trade 2: Today, evening

Investor B: Sell CDS protection
(long credit risk)

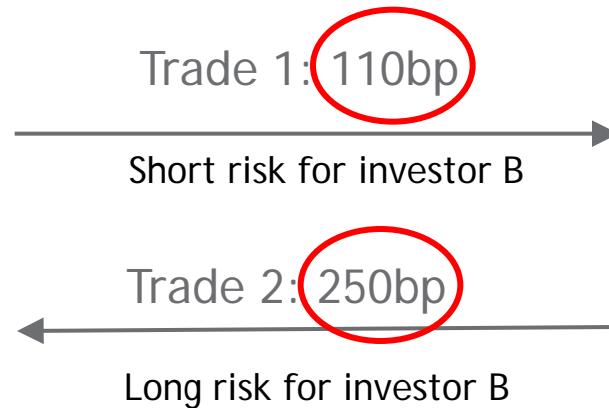
Credit: FedEx

Notional: \$10mm

Spread: 250bp

Maturity: 5 yrs (6/20/2018)

Investor B
Protection Buyer
(Short credit risk)



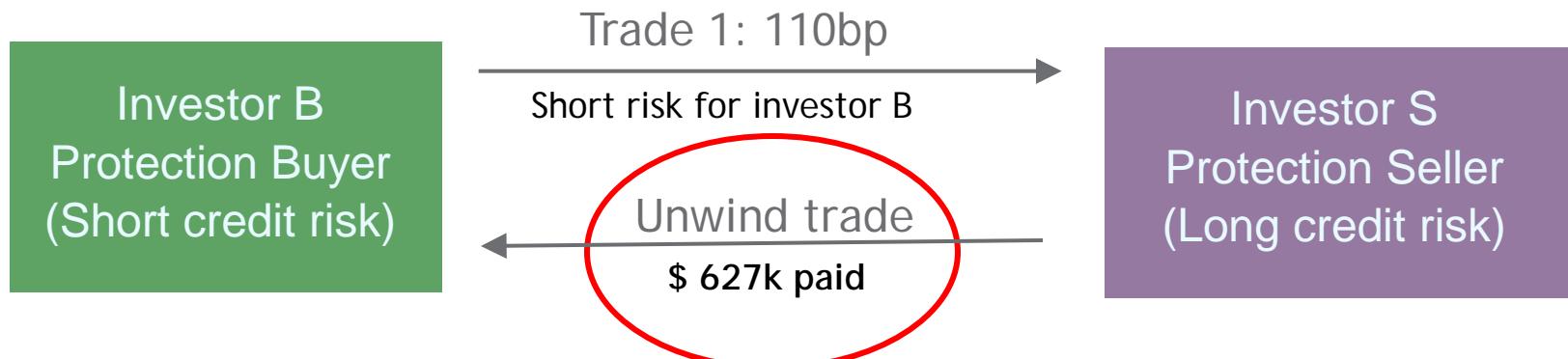
Investor S
Protection Seller
(Long credit risk)

Investor B2
Protection Buyer
(Short credit risk)

Net annual payment to investor B: 140bp

The second, more common method to monetize trades is to unwind them

- Investor B can unwind Trade 1 with Investor S, or with another dealer, presumably for a better price
- Investor B receives from Investor S cash equal to the present value of the expected payments, or an unwind payment. The present value calculation incorporates the probability of FedEx default
- The unwind payment is approximately: (change in spread) * (risky duration of par CDS) * (notional) = 140bp * 4.48 years * \$10mm $\approx \$627k$
- After unwinding the trade, investor B has no outstanding positions



“CDSW” calculator on Bloomberg is the industry standard in mark-to-market calculations

Maturity

Deal spread = 110bp fixed coupon

Recovery rate

CDS spread

Mark-to-Market

The screenshot shows the Bloomberg CDSW calculator interface with several highlighted fields:

- Maturity:** Set to 5Y 06/20/18.
- Recovery Rate:** Set to 0.40.
- Coupon (bp):** Set to 110.000.
- Day Cnt:** ACT/360.
- Pay AI:** True.
- Business Days:** 5D.
- Bus Day Adj:** 1 Amrt N.
- Calculator:** ISDA Standard Upfront Model (I)*.
- Cash Settled On:** 06/20/13.
- Valuation Date:** 06/17/13.
- Price:** 93.71999123.
- Principal:** 628,001.
- Accrued (90 Days):** -27,500.
- Cash Amount:** 600,501.
- Spread DV01:** 4,230.56.
- IR DV01:** -157.02.
- Rec Risk (1%):** -1,056.16.
- Def Exposure:** 5,371,999.

A red arrow points from the "Maturity" label to the "Maturity" field. Another red arrow points from the "Recovery rate" label to the "Recovery Rate" field. A third red arrow points from the "CDS spread" label to the "Coupon (bp)" field. A fourth red arrow points from the "Mark-to-Market" label to the "Price" field. A fifth red arrow points from the "Deal spread = 110bp fixed coupon" label to the "Coupon (bp)" field. A sixth red arrow points from the "ISDA Standard Upfront Model (I)*" label to the graph area.

*This application is based on the ISDA Std Model v1, developed and supported in collaboration with Markit Group Ltd.

Practically, CDS After the Big Bang: SNAC trades...

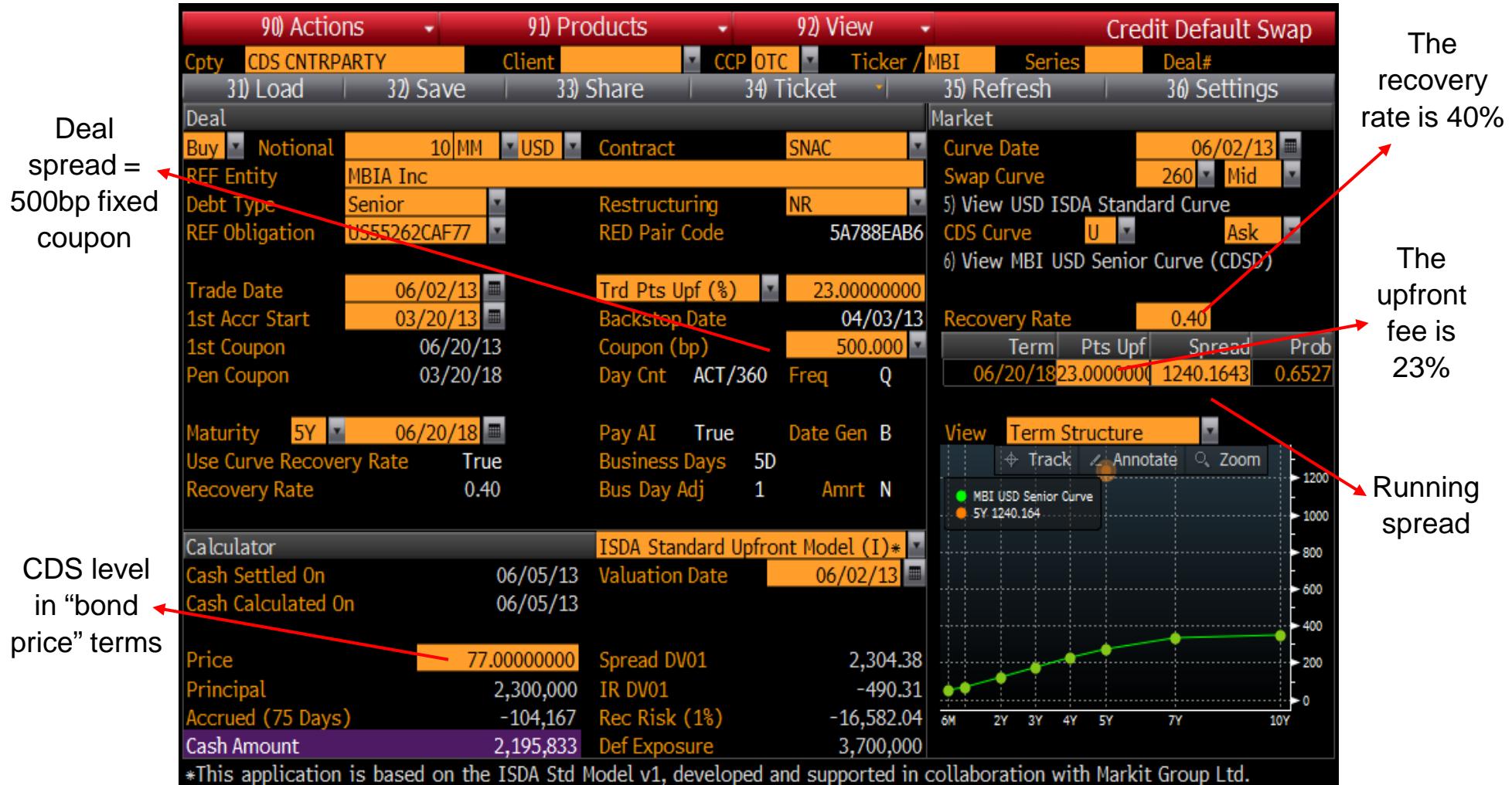
- SNAC = Standard North American Contracts (since April 2009)
- 100bp or 500bp fixed coupons
 - Full first coupon
 - Trades like a corporate bond, i.e., CDS protection buyer pays a 3-month coupon at the end of the first period no matter the trade date. To compensate for this, at the time of the trade they receive the coupon accrued from the previous coupon date to the trade date.
- NR credit events = Bankruptcy and Failure to Pay
- In Europe, fixed coupons are 25bp, 100bp, 500bp, 1000bp (with additional coupons of 300bp and 750bp). MMR credit events (includes restructuring).
- Sovereign CDS trade generally with 25bp, 100bp and 500bp coupons

CDS quoting conventions

- CDS is quoted in two ways
 - Running spread paid annually, e.g., 250bp
 - Upfront payment + running spread paid annually, e.g., 6.75% + 500bp
 - Generally, CDS trading with 100bp coupon are quoted in spread terms and CDS trading with 500bp coupon are quoted in upfront
 - Follows quoting conventions of HG and HY bond markets, respectively
- No matter the quoting convention, all US single-name CDS have upfront payments + annual running spreads of either 100bp or 500bp
 - Annual payments are made quarterly on the 20th of March, June, September, and December and accrue actual / 360
- Upfront is really like clean price of a bond
(more precisely, \$100 – CDS \$upfront is CDS in bond clean price terms)

How to convert “points upfront” into spread

- 23% + 500bp, assuming a recovery rate of 40% = 1240bp



Example: CDS Trader Run for a HG Sector, 5Y CDS Spread

<Menu> to Return to your Inbox

1) Delete 2) Reply 22) Reply All 3) Forward 12) Prev 11) Next 99) Options ▾ Message: View

May 31 2013 16:50:08

From: EDWARD KOO (JP MORGAN SECURITIES)

Attached: No Attachments

91) ⭐ 92) Move ▾ 94) Tags ▾

CDS/CASH TRADING {JPX <GO>} (W) 212-834-4112 Cell 917-868-7507

JPM CDS - 5y Month End - Retailers/Apparel

	Retailers	Discounters	Apparel
AZO	58/63 --	CVS 31/36 --	MAT 50/60 --
FD	74/79 --	HD 30/35 --	VFC 34/39 --
GPS	80/87 --	LOW 36/41 --	HAS 88/108 --
JCP	9/10 --	SPLS 183/193 --	LTD 173/188 --
JNY	295/310 --	TGT 32/37 --	
JWN	55/60 --	WMT 28/33 --	
KSS	143/153 --	TJX 34/39 --	
BBY	305/325 --		

Example: CDS Trader Run for Life Insurance, All Maturities

» <HELP> for explanation.
<Menu> to Return.

1) Delete 2) Reply 22) Reply All 3) Forward 12) Prev 11) Next 99) Options ▾ Message: View

✓ Jun 5 2013 07:53:13
From ERIK HAMMES (JP MORGAN SECURITIES)
Attached No Attachments 91) ☆ 92) Move▼ 94) Tags▼
 212.834.8734 914.844.5449 erik.hammes@jpmorgan.com {JPX <GO>}

JP Morgan CDS: Life Insurance Curves

	AIG	HIG	LNC	MET	PRUF	XL
1YR	20-30	15-25	25-35	25-35	20-30	15-25
2YR	45-55	40-50	50-60	50-60	45-55	25-35
3YR	65-75	60-70	70-80	75-85	70-80	35-45
4YR	85-95	80-90	100-110	100-110	95-105	50-60
5YR	115-120	105-110	130-135	125-130	120-125	60-65
7YR	145-155	135-145	160-179	155-165	150-160	75-85
10YR	160-170	150-160	175-185	170-180	165-175	85-95

Example: CDS Trader Run for a Wide Name, Upfronts

1) Delete 2) Reply 22) Reply All 3) Forward 12) Prev 11) Next 99) Options ▾ Message: View

✓ May 31 2013 12:03:24

From: DANIEL SHATZ (JP MORGAN SECURITIES)

Attached No Attachments 91) ☆ 92) Move ▾ 94) Tags ▾

Credit Trading W: 212 834 7557 C: 917 270 1602

Forwarded-Originally from: DANIEL SHATZ (JP MORGAN SECURITIES)

== JPM High Yield: TXU CDS CURVES (TCEH) == #3

TCEH

OM	6/13	3 /6
3M	9/13	29 /33
6M	12/13	50 /54
9M	3/14	63 /67
1Y	6/14	70 /74
1 $\frac{1}{4}$ Y	9/14	73 /77
1 $\frac{1}{2}$ Y	12/14	74 /78
2Y	6/15	78 /82
3Y	6/16	82 /85
4Y	6/17	83 $\frac{1}{2}$ /86 $\frac{1}{2}$
5Y	6/18	84 $\frac{1}{2}$ /87 $\frac{1}{2}$

The upfront convention makes trading straightforward
... buy low, sell high

Example 1

- a) Buy protection at 20% + 500bp
- Hold for 6 months
- b) Exit by selling protection for 30% + 500bp

Cash flows		
Pay	20%	
Pay	2.5%	
Receive	30%	
Net		+7.5%

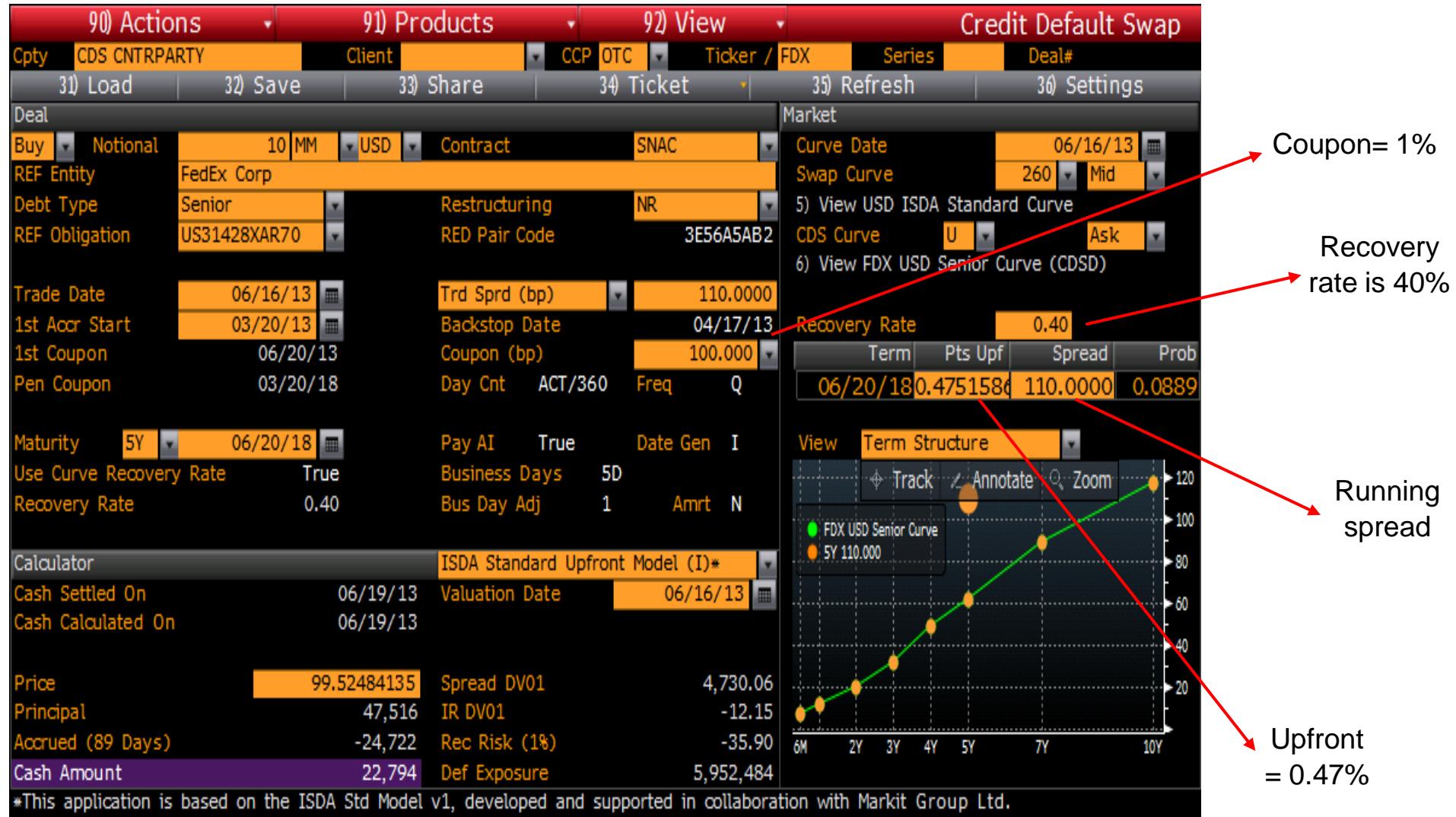
Example 2

- a) Sell protection at 10% + 500bp
- Hold for 1 year
- b) Exit by buying protection for 12% + 500bp
(the trade moved against you)

Cash flows		
Receive	10%	
Receive	5%	
Pay	12%	
Net		+3%

Working Out the FedEx Example Using CDSW

- 110bp with 100bp coupon assuming a recovery rate of 40% = 0.48% upfront



Working Out the FedEx Example Using CDSW – cont.

- 250bp with 100bp coupon assuming a recovery rate of 40% = 6.73%
- **PnL = 6.73% - 0.48% = 6.25% or \$625k**



Agenda

■ Module 1: Overview

- CDS market overview and update on new market regulations

■ **Module 2: CDS basics and pricing**

- CDS fundamentals: how contracts work, trading and valuation
- **CDS pricing in more details**

■ Module 3: Relative value trading

- CDS vs bonds
- CDS curves

■ Module 4: Index products

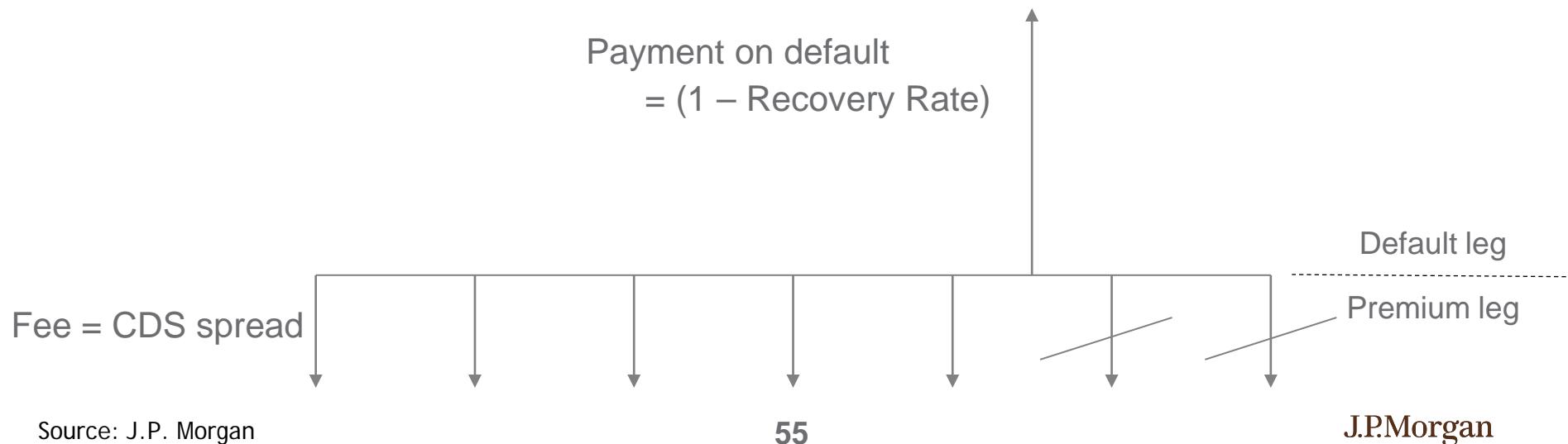
- CDX indices and iBoxx TRS
- Index options and Index tranches

CDS Pricing

- CDS pricing guiding principle: What you pay is what you get
- Risky present value
- CDS spreads and default probability
- What's behind CDSW
- From par spread to upfront + fixed coupon

Guiding Principle

- One principle: What you expect to pay is what you expect to get
 - When investors enter into a CDS trade, the risky present value of the fees is equal to the risky present value of the payment in default
 - Risky PV discounts for both time-value of money and cash flow risk
- Need three inputs to determine CDS spread for a given maturity date
 - Interest rate
 - Probability of default
 - Recovery rate in default



Risky Present Value of a 100bp CDS Fee Leg

Zero Interest Rate World

$$PV = 100\text{bp} \times 5$$

$$PV = 500c = 5\%$$

100bp per year



Non-Zero Interest Rate World

$$PV = 100\text{bp} \times 4.75$$

$$PV = 475c = 4.75\%$$

100bp per year



Risky Non-Zero Interest Rate World

$$PV = 100\text{bp} \times 4.5$$

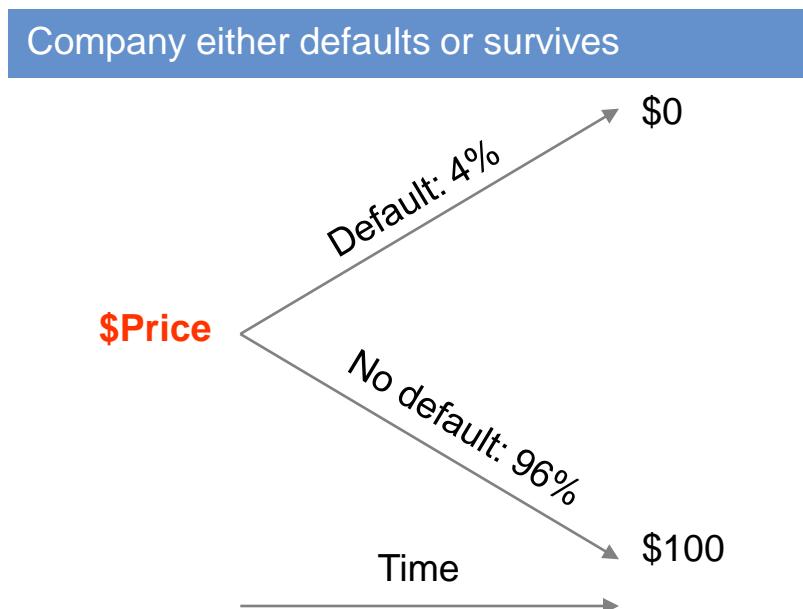
$$PV = 450c = 4.5\%$$

100bp per year



Risky Present Value

- Assume you have a risky zero-coupon bond with 1 year to maturity
 - 1Y interest rate is 1%
 - 1Y probability of default is 4% (i.e. 96% chance of surviving)
 - Bonds recovers \$0 in default (i.e. 0% recovery rate / 100% loss in default)
- How much should you pay for this bond today?

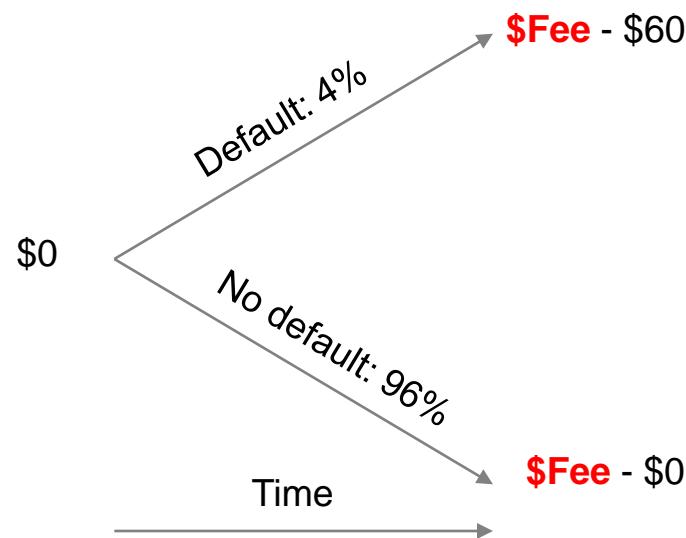


- Multiply each future value by the probability of it occurring and then discount these at risk-free rate
 - PV if default = $\$0 \times 4\% / (1+1\%) = \0
 - PV if no default = $\$100 \times 96\% / (1+1\%) = \95
 - Bond Risky PV = (PV if default) + (PV if no default)
► **Price = \$95**
- Risk reduces the value of each future cash flow
- “Risky discount factor” = probability of cash flow occurring * risk-free discount factor

Intuition Behind Spreads and Default Prob.: CDS Risky PV

- Assume a CDS: notional = \$100, maturity = 1yr
 - 1Y interest rate is 1%
 - 1Y probability of default is 4% (i.e. 96% chance of surviving)
 - Recovery rate is 40% (i.e. \$60 loss in default for protection seller)
- What should be the spread (i.e. the fee) for that CDS?

CDS protection seller: gets fee and might have to pay in case of default



- \$Fee = spread x \$100
- In default, protection seller pays $(1-40\%) \times \$100 = \60
- CDS risky present value = \$0 (WYPIWYG)
- Multiply each future value by the probability of it occurring and then discount these at risk-free rate
 - PV if default = $(\$Fee - \$60) \times 4\% / (1+1\%)$
 - PV if no default = $(\$Fee - \$0) \times 96\% / (1+1\%)$
 - $\$0 = (\$Fee - \$60)^*4\% / (1+1\%) + (\$Fee - \$0)^*96\% / (1+1\%)$
 - ▶ **\$Fee = \$2.40, i.e. spread = 240bp**
- CDS Spread = $(1-\text{Recovery Rate}) * \text{Annual Default Prob.}$

Default Probabilities Using CDSW

- CDSW calculates cumulative default probability
- “Model” to “ISDA Fair Val” to get default prob. for different time horizons

Credit Default Swap

90) Actions		91) Products		92) View			
Cpty	CDS CNTRPARTY	Client	CCP OTC	Ticker / FDX	Series	Deal#	Market
31) Load	32) Save	33) Share	34) Ticket	35) Refresh	36) Settings		
Deal							
Buy	Notional	10 MM	USD	Contract	SNAC		Curve Date 06/18/13
REF Entity	FedEx Corp			Restructuring	NR		Swap Curve 260 Mid
Debt Type	Senior			RED Pair Code	3E56A5AB2		5) View USD ISDA Standard Curve
REF Obligation	US31428XAR70						CDS Curve U Ask
Trade Date	06/18/13			Trd Sprd (bp)	61.0000		6) View FDX USD Senior Curve (CDSD)
1st Accr Start	03/20/13			Backstop Date	04/19/13		
1st Coupon	06/20/13			Coupon (bp)	100.000		
Pen Coupon	03/20/18			Day Cnt ACT/360	Freq Q		
Maturity	5Y 06/20/18			Pay AI True	Date Gen I		
Use Curve Recovery Rate	True			Business Days US GB			
Recovery Rate	0.40			Bus Day Adj 1 Amrt N			
Calculator							
ISDA Fair Value Model (V)*							
Cash Settled On	06/21/13	Valuation Date	06/18/13				
Cash Calculated On	06/21/13	MTM	-215,871				
Price	101.90596399	Repl Sprd (bp)	61.0000				
Principal	-190,596	Spread DV01	4,964.33				
Accrued (91 Days)	-25,278	IR DV01	49.49				
Cash Amount	-215,874	Rec Risk (1%)	52.42				
		Def Exposure	6,190,596				
*This application is based on the ISDA Std Model v1, developed and supported in collaboration with Markit Group Ltd.							

Default Probability

The Math behind CDSW: Par Spread

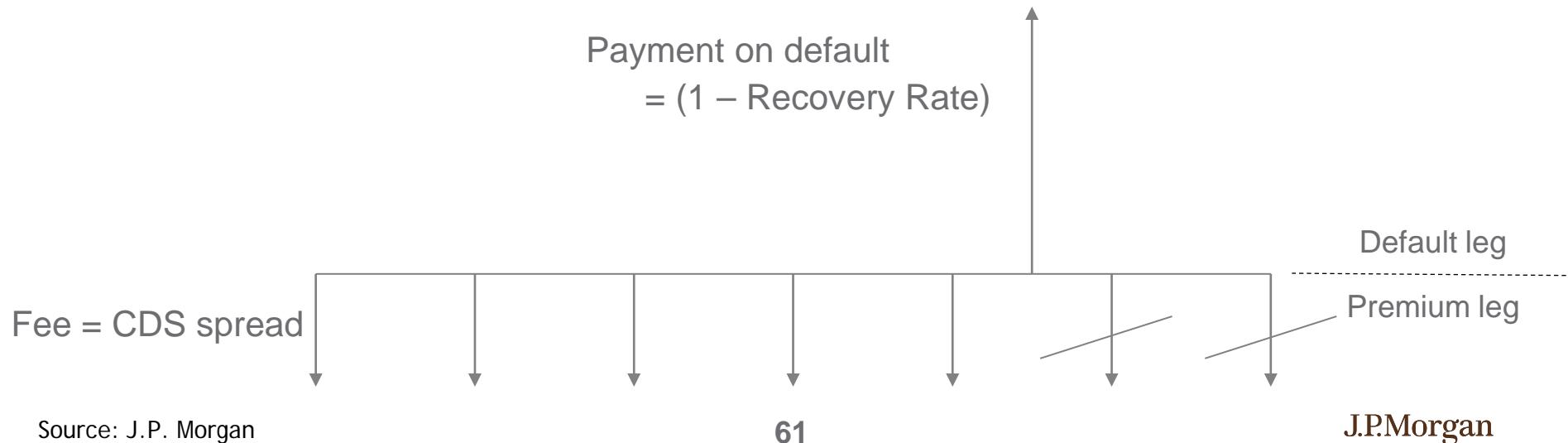
- What you pay is what you get: RPV (Premium Leg) = RPV (Default Leg)

$\text{spread} \rightarrow S_n \cdot \sum_{i=1}^n \Delta_i \cdot \overbrace{P_{S_i}}^{\text{prob of survival}} \cdot DF_i + S_n \cdot \sum_{i=1}^n \frac{\Delta_i}{2} \cdot \overbrace{(P_{S_{i-1}} - P_{S_i})}^{\text{prob of default}} \cdot DF_i$ <p style="margin-top: 10px;">fee contingent on no default (i.e. survival)</p> <p style="margin-top: 10px;">average accrual that is owed on default</p> <p style="text-align: center;">Premium Leg</p>	$= (1 - R) \cdot \sum_{i=1}^n \overbrace{(P_{S_{i-1}} - P_{S_i})}^{\text{prob of default}} \cdot DF_i$ <p style="margin-top: 10px;">Expected value of default payment</p> <p style="text-align: center;">Default Leg</p>
---	---

- In practice, S_n is given in the market. So, we are really solving for $P_s(t)$ in each period (i.e. solving for conditional probabilities of default in each period)
- Of course, we can change $P_s(t)$ and see the change in spread needed as well, but investors don't usually start out with a view on $P_s(t)$

Guiding Principle

- One principle: What you expect to pay is what you expect to get
 - When investors enter into a CDS trade, the risky present value of the fees is equal to the risky present value of the payment in default
 - Risky PV discounts for both time-value of money and cash flow risk
- Need three inputs to determine CDS spread for a given maturity date
 - Interest rate
 - Probability of default
 - Recovery rate in default



The Math behind CDSW: Par Spread

- What you pay is what you get: RPV (Premium Leg) = RPV (Default Leg)

$\text{spread} \rightarrow S_n \cdot \sum_{i=1}^n \Delta_i \cdot \underbrace{\overbrace{P_{S_i}}^{\text{prob of survival}}}_{\text{fee contingent on no default (i.e. survival)}} \cdot DF_i + S_n \cdot \sum_{i=1}^n \frac{\Delta_i}{2} \cdot \underbrace{\overbrace{(P_{S_{i-1}} - P_{S_i})}^{\text{prob of default}}}_{\text{average accrual that is owed on default}} \cdot DF_i$ <p style="text-align: center;">Premium Leg</p>	$= (1 - R) \cdot \sum_{i=1}^n \underbrace{\overbrace{(P_{S_{i-1}} - P_{S_i})}^{\text{prob of default}}}_{\text{Expected value of default payment}} \cdot DF_i$ <p style="text-align: center;">Default Leg</p>
--	---

- In practice, S_n is given in the market. So, we are really solving for $P_s(t)$ in each period (i.e. solving for conditional probabilities of default in each period)
- Of course, we can change $P_s(t)$ and see the change in spread needed as well, but investors don't usually start out with a view on $P_s(t)$

The Math behind CDSW: Fixed Coupon and Upfront

- When upfront payments are given/received by the protection buyer, just add/subtract this to the Premium Leg and solve for the new spread (S_n)
- If fixed coupon, set S_n to coupon value and add/subtract upfront to Premium Leg so that the two sides of the equation above are equal
- What you pay is what you get: RPV (Premium Leg) = RPV (Default Leg)

$U_n + C \cdot \sum_{i=1}^n \Delta_i \cdot \overbrace{Ps_i}^{\text{prob of survival}} \cdot DF_i + C \cdot \sum_{i=1}^n \frac{\Delta_i}{2} \cdot \overbrace{(Ps_{i-1} - Ps_i)}^{\text{prob of default}} \cdot DF_i$ <p style="text-align: center;">upfront coupon prob of survival discount factor</p> <p style="text-align: center;">$\underbrace{U_n + C \cdot \sum_{i=1}^n \Delta_i \cdot Ps_i \cdot DF_i}_{\text{fee contingent on no default (i.e. survival)}}$</p> <p style="text-align: center;">$\underbrace{C \cdot \sum_{i=1}^n \frac{\Delta_i}{2} \cdot (Ps_{i-1} - Ps_i) \cdot DF_i}_{\text{average accrual that is owed on default}}$</p> <p style="text-align: center;">Premium Leg</p>	$(1 - R) \cdot \sum_{i=1}^n \overbrace{(Ps_{i-1} - Ps_i)}^{\text{prob of default}} \cdot DF_i$ <p style="text-align: center;">recovery rate</p> <p style="text-align: center;">$\underbrace{(1 - R) \cdot \sum_{i=1}^n (Ps_{i-1} - Ps_i) \cdot DF_i}_{\text{Expected value of default payment}}$</p> <p style="text-align: center;">Default Leg</p>
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Risky Annuity and Risky Duration

- **Risky annuity** is the present value of a risky 1bp annuity

- $$\text{Risky annuity} = 1\text{bp} \cdot \sum_{i=1}^n \Delta_i \cdot \overbrace{Ps_i}^{\text{prob of survival}} \cdot DF_i + \text{Accruals on Default}$$

- Rewrite Fee Leg as:

$$\text{Fee Leg} = S_n \cdot \underbrace{RA_n}_{\text{Risky Annuity}} = U_n + C \cdot RA_n$$

- **Risky duration** relates to a trade and is the mark-to-market on a trade for a 1bp parallel shift in spreads
- For par CDS contract: Risky duration \approx Risky annuity, but this is not true in general for CDS trading with fixed coupon
- The terms are often used interchangeably (sometimes incorrectly)

From Upfront to Par Spread and Vice Versa

- Risky Annuity relates par spread to upfront/coupon

- Fee Leg can be written as

$$\text{Fee Leg} = S_n \cdot \underbrace{RA_n}_{\text{Risky Annuity}} = U_n + C \cdot RA_n$$

- CDS w/ fixed coupon: $\boxed{\text{Upfront} = (\text{Par spread} - \text{Coupon}) * \text{Risky annuity}}$

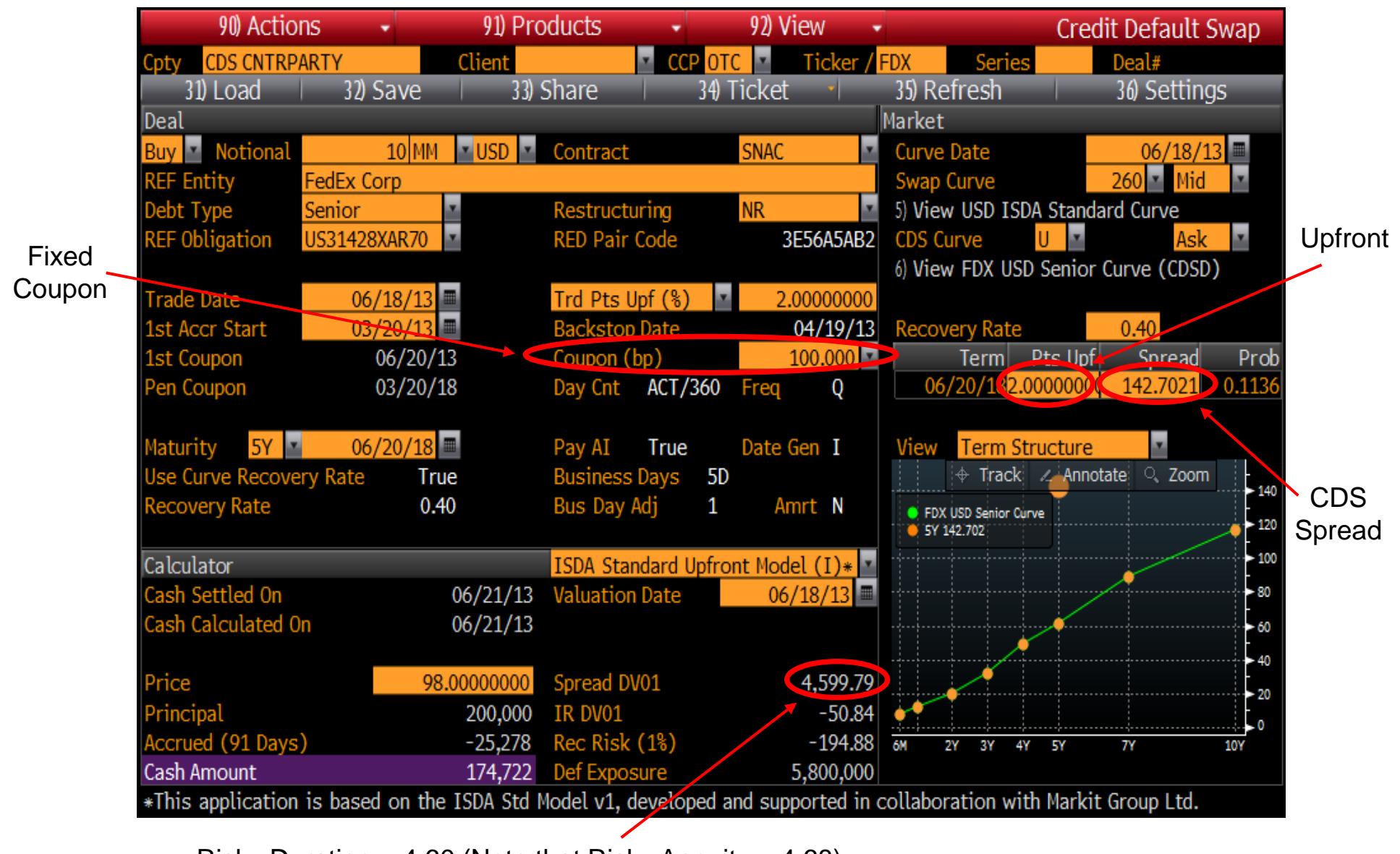
- Example: 5y CDS, 143bp spread, 100bp coupon

- Risky annuity = 4.68y
 - Upfront: $(143\text{bp} - 100\text{bp}) * 4.68 = 2.0\%$

- Risky Duration and Risky Annuity are different if upfront is different from zero

- Risky duration for the example above = 4.60y

Information on the CDSW Screen

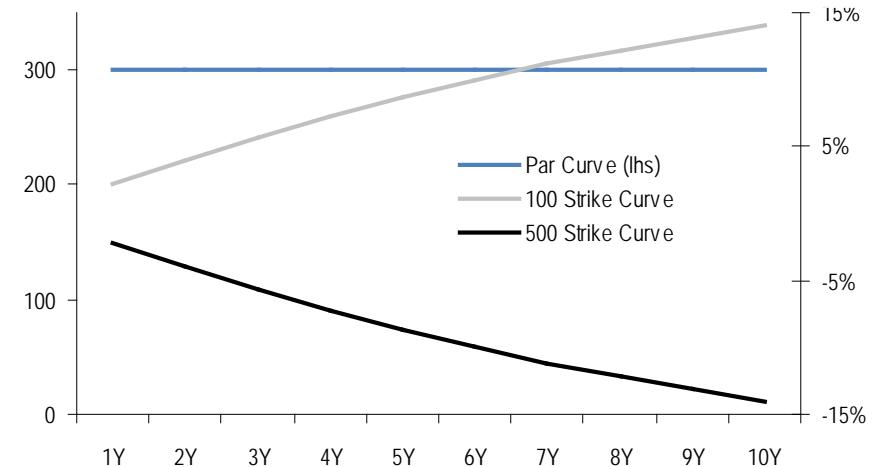


Upfront and Fixed Coupon vs Par Spread

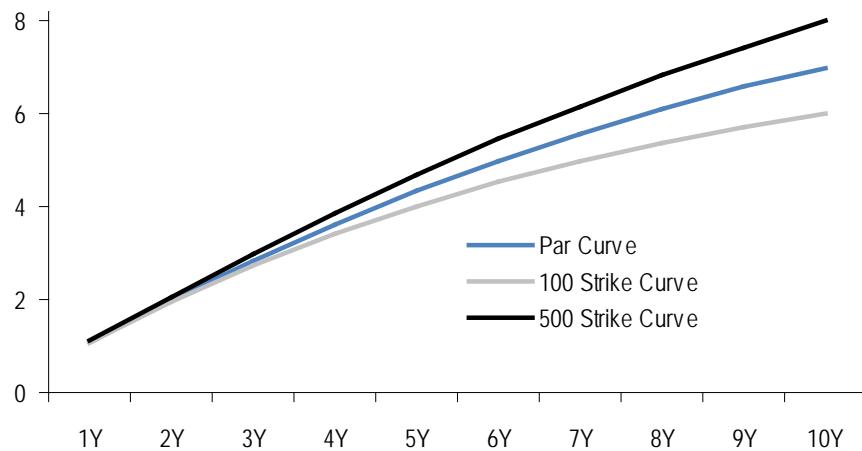
Trading w/ upfront affects sensitivities

- Time value (carry + slide)
- Risky duration
- Default timing
- 500bp cpn: larger time value and risky duration than 100bp cpn

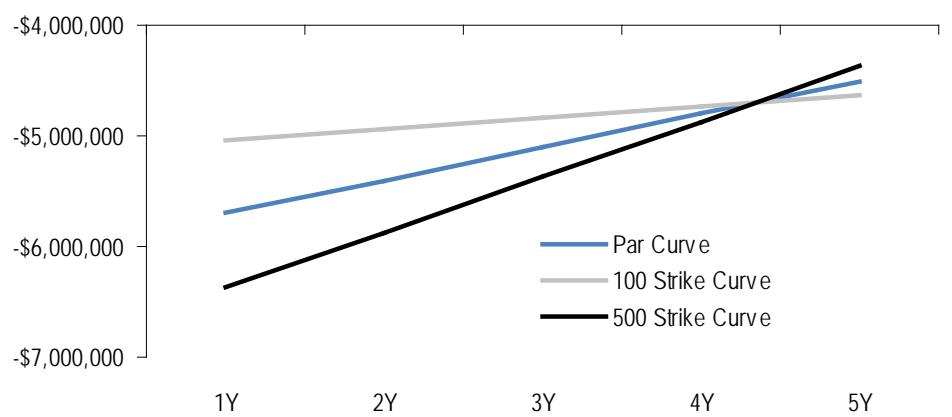
Par Spread CDS Curve



MtM: Risky Durations



Default: Loss in Default vs time



CDS Pricing: Summary

- What you expect to pay is what you expect to get
- Risky present value takes into account default probability and risk-free discount factor
 - CDS spread = $(1 - \text{Rec. rate}) \times \text{Annual default probability}$
 - CDS upfront = $(\text{Par spread} - \text{Coupon}) \times (\text{present value of risky 1bp})$
- Trade sensitivities depend on fixed coupon

10 MINUTE BREAK

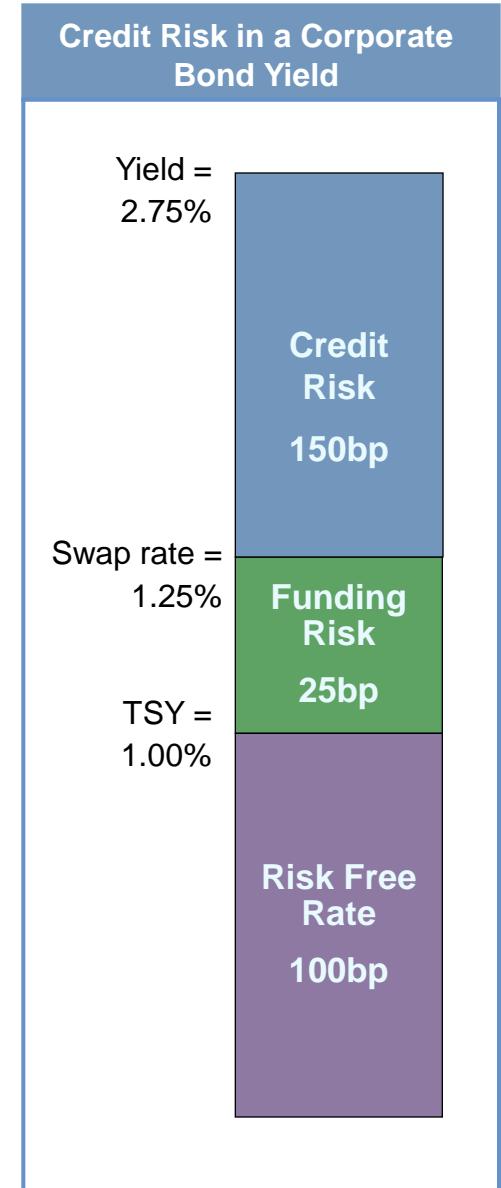
Refreshments outside

Agenda

- Module 1: Overview
 - CDS market overview and update on new market regulations
- Module 2: CDS basics and pricing
 - CDS fundamentals: how contracts work, trading and valuation
 - CDS pricing in more details
- **Module 3: Relative value trading**
 - **CDS vs bonds**
 - CDS curves
- Module 4: Index products
 - CDX indices and iBoxx TRS
 - Index options and index tranches

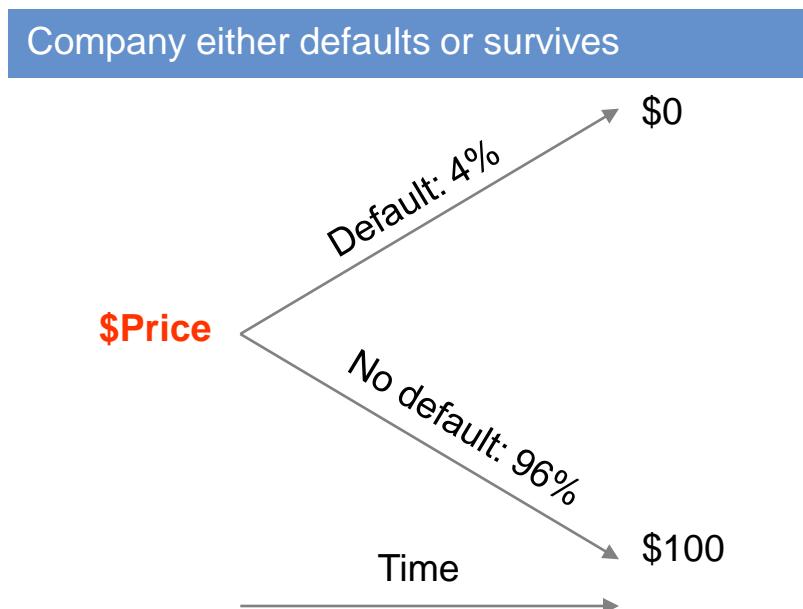
Credit Spread as Default Compensation

- Credit spread on a corporate bond: additional return earned above the 'risk-free' rate, compensates for exposure to corporate risk
- Corporate risk is risk of default or deterioration in credit-worthiness
- Bond all-in yield can be decomposed into three parts:
 - 3) Credit risk – Credit spread
 - 2) Funding risk – Swap spread
 - 1) Risk free rate – Treasury rate
- CDS focuses on credit risk only



Bond Spread and Default Probability

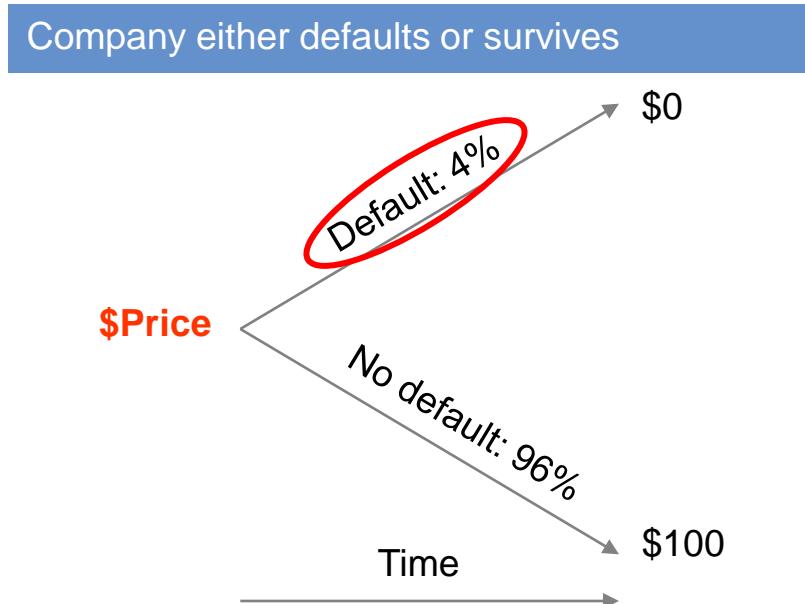
- Assume you have a risky zero-coupon bond with 1 year to maturity
 - 1Y swap rate is 1%
 - 1Y probability of default is 4% (i.e. 96% chance of surviving)
 - Bonds recovers \$0 in default (i.e. 0% recovery rate / 100% loss in default)
- How much should you pay for this bond today?



- Multiply each future value by the probability of it occurring and then discount these at risk-free rate
 - PV if default = $\$0 \times 4\% / (1+1\%) = \0
 - PV if no default = $\$100 \times 96\% / (1+1\%) = \95
 - Bond Risky PV = (PV if default) + (PV if no default)
► **Price = \$95**
- Risk reduces the value of each future cash flow
- “Risky discount factor” = probability of cash flow occurring x risk-free discount factor

Bond Spread and Default Probability – Cont.

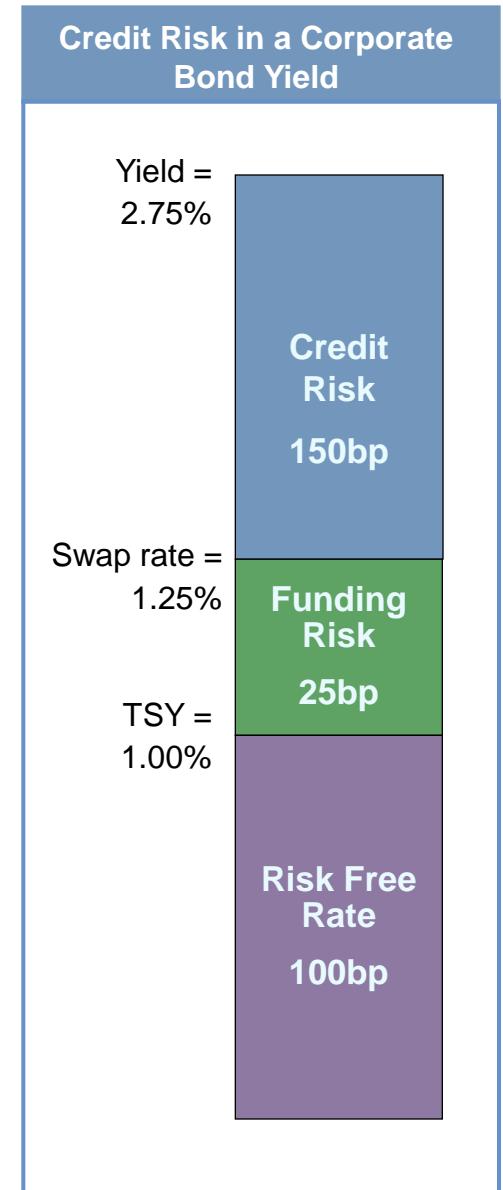
- Usual way to look at this bond is: Yield is 5% and Swap rate is 1%. Therefore, bond spread is 4%
- 4% spread with 0% recovery rate → 4% default prob. (recall $S = (1-R) * PD$)
- Same as the default probability we used to get risky PV → It matches!
- Therefore, thinking about bonds in yield/spread terms is actually the same as looking at them in a Risky PV perspective, like we did for CDS



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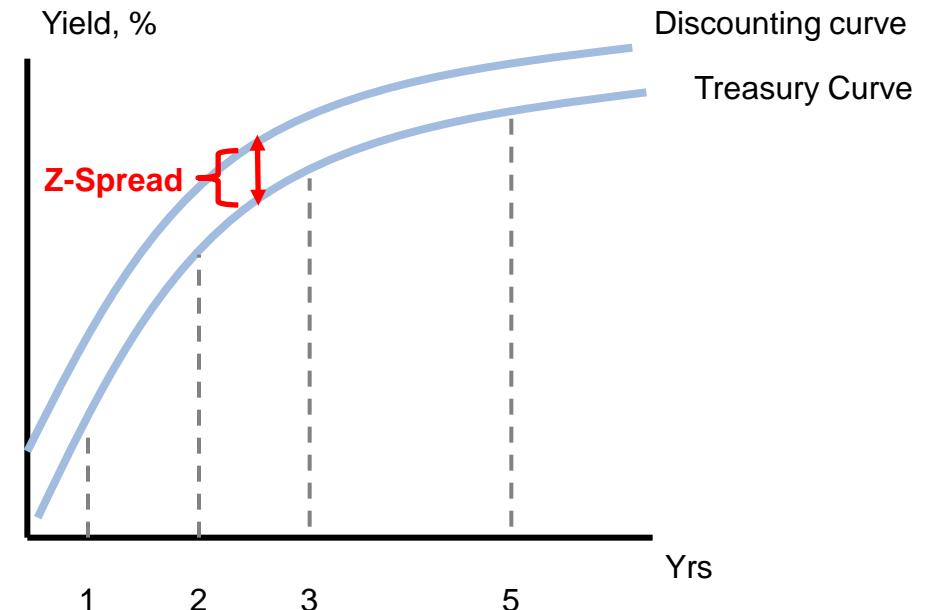
Trading Bonds vs CDS

- Compare bond spread over swaps to CDS spread with same maturity date
- If bond spread is larger than CDS spread
 - Bond is trading cheap relative to CDS
 - Buy the bond and buy CDS protection
 - “Negative CDS-bond basis”
- If bond spread is smaller than CDS spread
 - Bond is trading expensive relative to CDS
 - Sell the bond and sell CDS protection
 - “Positive CDS-bond basis”



Which Bond Spread Is Comparable to the CDS Spread?

- Investors use different bond spread measures
 - Benchmark spread: Yield diff btwn bond and benchmark Tsy
 - I-spread to Treasury: Yield diff btwn bond and maturity interpolated Tsy
 - Z-spread to swaps: Spread over whole swap rate curve



- Each spread has its pros and cons
- Z-spread is good approx, but we prefer Par Equivalent CDS Spread (PECS)
- In any case, the bond spread measure should include the risks in the bond beyond its interest rate risk exposure

Par-Equivalent CDS Spread (PECS)

- To compute the “CDS equivalent” spread of a bond, need to take into account all the information available
 - Bond price and coupons
 - Full swap rate curve
 - Full CDS curve
 - Assumed recovery rate
- Par-Equivalent CDS Spread: bond credit spread measure consistent with the recovery rate and term structure of default probabilities priced into the CDS market
- Z-Spreads is handy and standard measure, but not designed to be compared against the CDS spread. They tend to be similar to the PECS if bonds trade close to par, but can be very different otherwise
- PECS calculator: VCDS <GO> in Bloomberg

Why use PECS? Z-spread can sometimes be misleading

- Z-spread can sometimes be misleading,
 - F 8.875 2022: trades at \$128
i.e. 4.8% yield, 294bp G-sprd and 290bp Z-sprd
 - Assume F 10y CDS trades at 290bp as well
 - According to Z-sprd: Bond and CDS trade on top of each other
 - BUT in default, bond investor will lose more than CDS investor (\$88 vs \$60 if recovery rate is 40%). So, bond investor has more risk than CDS investor and Z-spread of an equivalent par bond (i.e. PECS) should be tighter
- How much does it cost to hedge bond with CDS?
 - \$115 of CDS protection is needed to protect \$100 invested in the bond
 - In default, CDS pays \$60 and bond loses \$69 per \$100 invested (i.e. \$88 / \$128)
 - \$115 CDS protection pays \$69 in default ($60\% * \115) and compensates for the bond default risk
 - Annual cost of \$115 CDS protection is 332bp, compared to 290bp Z-sprd on bond
 - Therefore, bond is actually about 42bp tight to its CDS

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 - Approximate formula to go from Z spread to PECS:

$$\text{PECS} \approx \frac{\% \text{ loss on par}}{\% \text{ loss on actual price}} * \text{Z-spread}$$

- In the case above: PECS is about 253bp
 $(=290\text{bp} * 60\% / 69\%; \text{ since } 69\% = \$88/\$128)$
- So, in this case, F 8.875 2022 is actually tight to its CDS by approx. 37bp

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Par-Equivalent CDS Spread: VCDS <GO>

■ Example: F 8.875 01/15/22

F 8 7/8 01/15/22				Bond Valuation from Credit Default Spreads			
Bond Information				Discount Curve			
Ford Motor Co				Curve Date	06/17/2013		
Bloomberg ID	345370BJ8	Coupon	8.875	US Custom Curve	23	Mid	
Ratings				22) Curve Details			
Baa3/BB+/BBB-		Maturity Date	01/15/2022				
Bond Calculation				Credit Default Spread Curve			
Z-spread	Settlement Date	06/20/2013	Workout Date	01/15/2022	100602 USD Senior		
			Workout Price	100.000	CDS Spreads (bps)	Default	
	Market Price	128.000	Market Yield	4.843	Term	Flat	Y
	Spread Versus Benchmark (bps)	270.73			12/20/2013	290.0000	0.0247
	Benchmark Bond	T 1 3/4 05/15/23			06/20/2014	290.0000	0.0482
	Benchmark Price	96-05+	Benchmark Yield	2.181659	06/20/2015	290.0000	0.0937
	Z-Spread (bps)	290.22			06/20/2016	290.0000	0.1371
					06/20/2017	290.0000	0.1784
					06/20/2018	290.0000	0.2176
					06/20/2020	290.0000	0.2906
					06/20/2023	290.0000	0.3875
Bond Valuation from Credit Default Spreads				CDS-Bond basis (this bond is trading 37bp tighter than its CDS)			
Recovery Rate	0.4000	Model	B				
Calculation Mode	DAS						
Model Price	125.390	Model/Mkt Price Diff.	-2.61	Frequency	Quarterly		
Model Yield	5.169	Model/Mkt Yield Diff. (bps)	32.61	Day Count	ACT / 360		
Default Adjusted Spread (DAS)(bps)	36.8164			Recovery Rate	0.4000		

Source: Bloomberg, J.P. Morgan

80

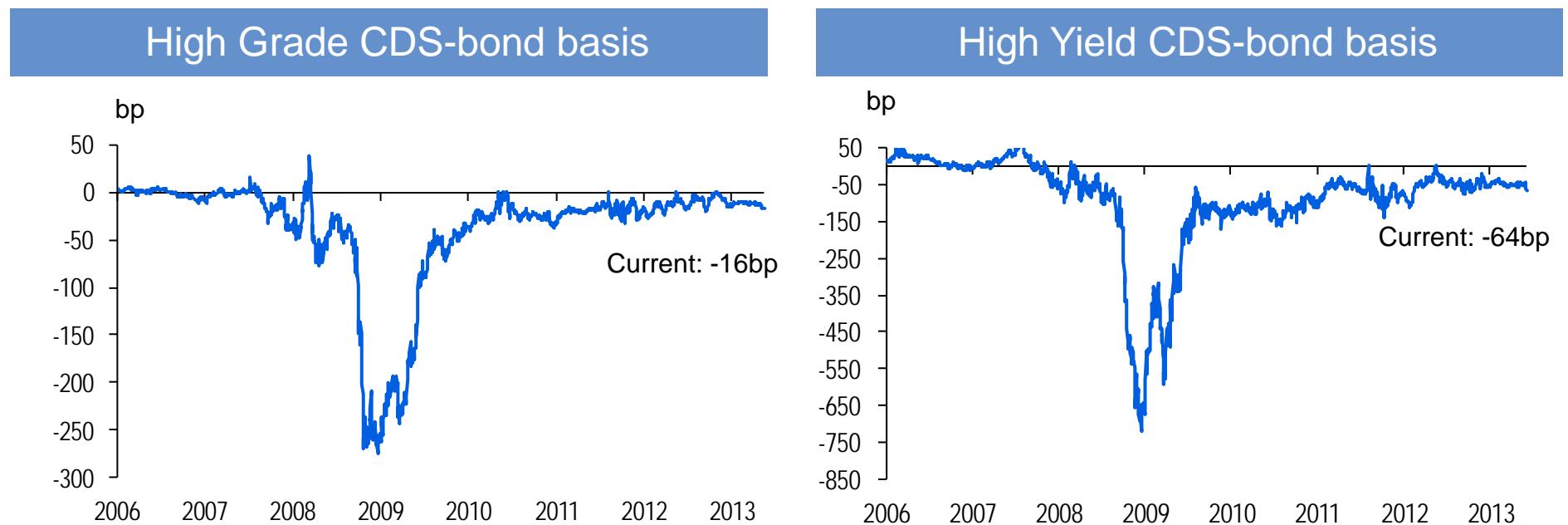
J.P.Morgan

Par-Equivalent CDS Spread (PECS) – Behind VCDS

- The bond PECS is calculated by discounting the bond cash flows so that the sum of the risky PV of these cash flows is equal to market bond price
- The discount curve used for the discounting is constructed as follows
 - From the full CDS curve traded in the market and a recovery rate assumption, calculate the implied default probability curve for the company
 - Using this default probability curve and the full swap rate curve, calculate the sum of the risky PV of the bond cash flows
 - Stop if this sum is equal to the bond price; otherwise, parallel shift the CDS-implied default probability curve until the sum of the risky PV of the bond cash flows is equal to the market bond price
 - Convert this shifted default probability curve back into a spread curve
 - The bond PECS is the spread on that curve that corresponds to the bond maturity date

CDS-Bond Basis History

- Historically, CDS-bond basis had been close to zero and mean reverting
- But basis became very negative during the credit crisis
- Why did the basis move so much? What drives the basis? How do you trade it? Is it risk free?



CDS-Bond Basis Drivers

- Spread reflects all the risks and costs perceived by investors: credit risk, liquidity risk and funding/trading costs
- Differences between CDS and bond markets can drive basis away from zero
- On aggregate, CDS-bond basis will narrow only if CDS-bond “arbitrage” is economically sensible

Drivers	Effect on Basis
Bond issuance (in illiquid and deteriorating credit conditions)	Negative Basis
Bond issuer call options	Negative Basis
Bond repo costs	Negative Basis
Funding costs	Negative Basis
Higher CDS relative liquidity (tightening spreads)	Negative Basis
Issuance of synthetic structured products	Negative Basis
Risk on Non-deliverables	Negative Basis
Bond covenants protecting bond holders	Positive Basis
Cheapest-to-deliver option	Positive Basis
Higher CDS relative liquidity (widening spreads)	Positive Basis
Soft Credit Events	Positive Basis
Unwind of synthetic structured products	Positive Basis

Trading the Basis

- Compare CDS and bond pairs and identify attractive basis opportunities
- Choose the notional in each leg of the bond and CDS position to get
 - Trade sensitivity to spread movements and to default
 - Costs due to carry, upfront, funding, etc.
- Three popular ways to trade the basis
 - Equal notional – the most popular
 - Default weighted – no loss in principal in case of default
 - Duration weighted – not sensitive to equal moves in both spreads
- Different sizings mean different economics for basis trades

Exposure in Case of Default: Negative Basis Example

- Negative basis package: buy bond and buy CDS protection
- Buy bond:
 - Pay price (incl. accrued interest)
 - Receive bond coupon
 - Get bond recovery in default
- Buy CDS protection:
 - Pay/receive upfront (incl. accrued interest)
 - Pay CDS fixed coupon and swap rate
 - Get bond loss in default (i.e. 1 - recovery rate)
- Altogether in default (Bond price and all other variables in % terms):
$$\text{Bond notional} * (-\text{Bond price} + \text{Bond cpn} + \text{Recovery})$$
$$+ \text{CDS notional} * (-\text{CDS upft} - \text{CDS cpn} - \text{Swap rate} + 1 - \text{Recovery})$$

Equal Notional Negative Basis Trades: Default Sensitivity

- Bond at par and CDS upfront is zero: \$100 equal notional trade
 - $\$100 * (\text{Bond cpn} - \text{CDS cpn} - \text{Swap rate}) * \text{time to default (or maturity)}$
 - Truly gets basis
- Bond at par and CDS upfront is positive: \$100 equal notional trade
 - $-\$100 * \text{CDS upft} + \$100 * (\text{Bond cpn} - \text{CDS cpn} - \text{Swap rate}) * \text{time to def}$
 - Gets basis, but loss from CDS upfront (since CDS upfront is positive)
- Bond at a premium and CDS upfront is positive: \$100 equal notional trade
 - $-\$100 * (\text{Bond premium} + \text{CDS upfrt})$
 $+ \$100 * (\text{Bond cpn} - \text{CDS cpn} - \text{Swap rate}) * \text{time to default}$
 - Gets basis, but loses both bond premium and CDS upfront
- First trade really captures basis, but the last two trades do not

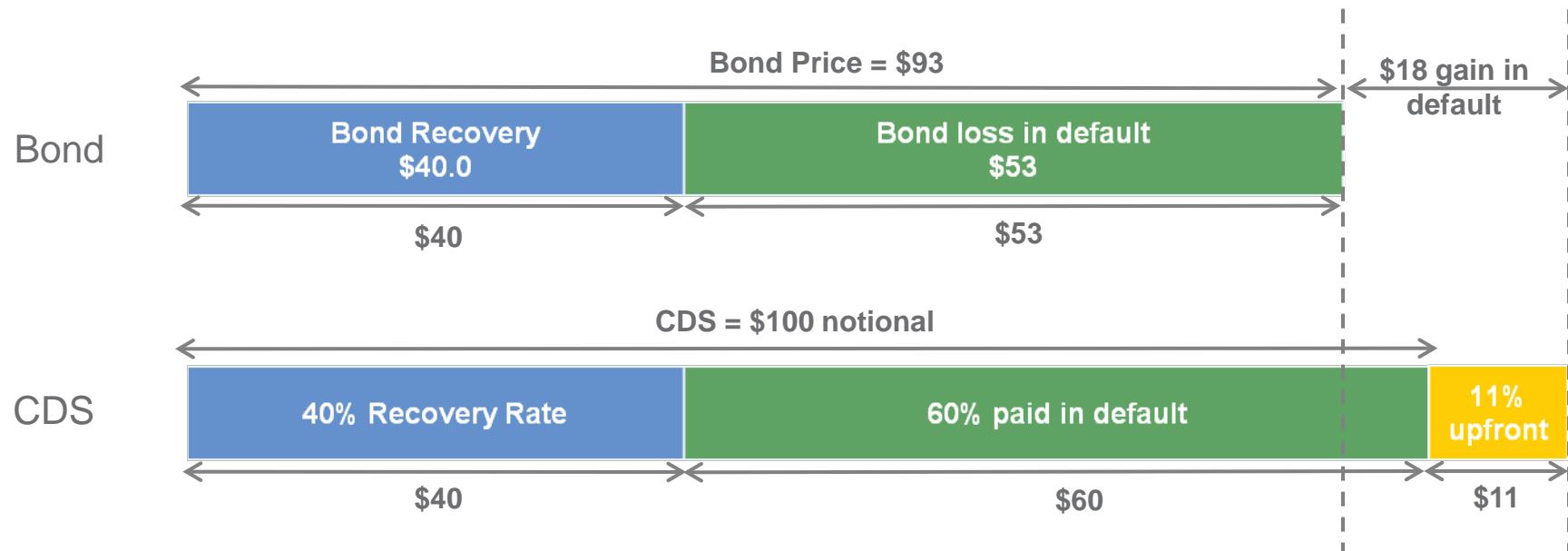
Sizing for Basis: Example

- MAS 4.8% 2015 bond in February 2010

MAS 4.8 6/15/15	
Maturity	6/15/2015
Face	\$100.00
Price	\$93.00
Coupon	4.80%
Yield	6.36%
Z-sprd / LIBOR	368
PECS	374
Recovery Rate	40%
CDS	261
CDS-Bond Basis	-113

Example: MAS 4.8% 2015 and CDS trading with 500bp Cpn, Equal Notional

- CDS upfront -11.2% for 500bp strike
- Sizing: \$100 notional on CDS



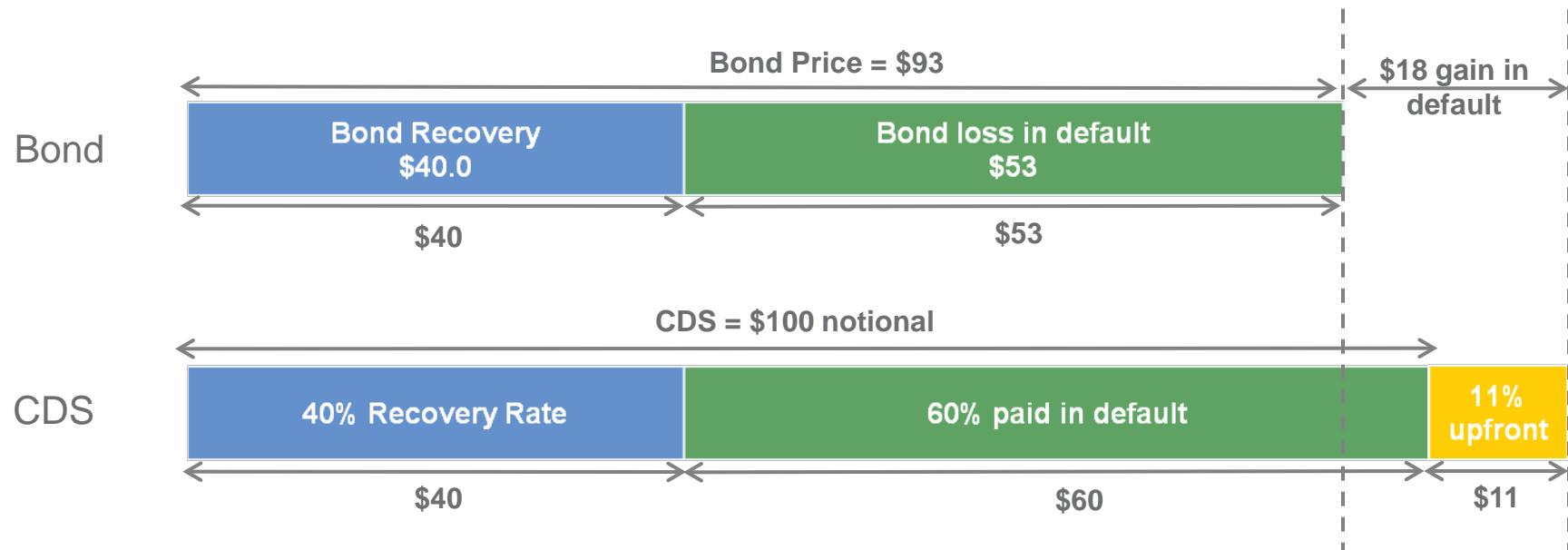
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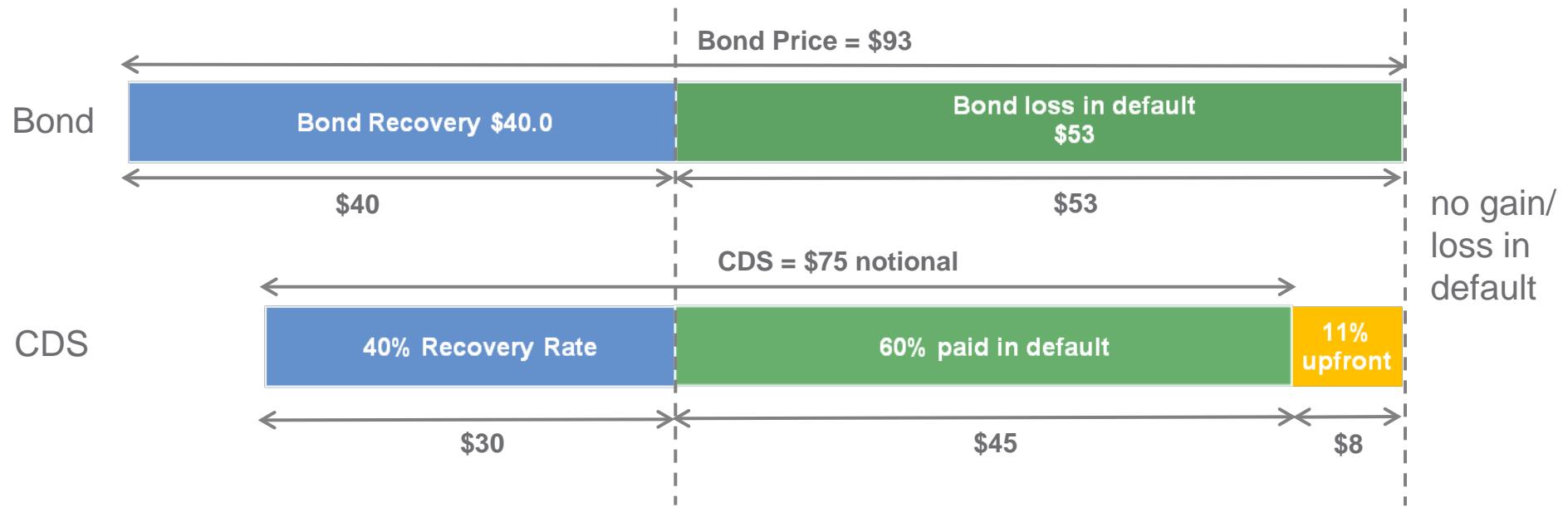
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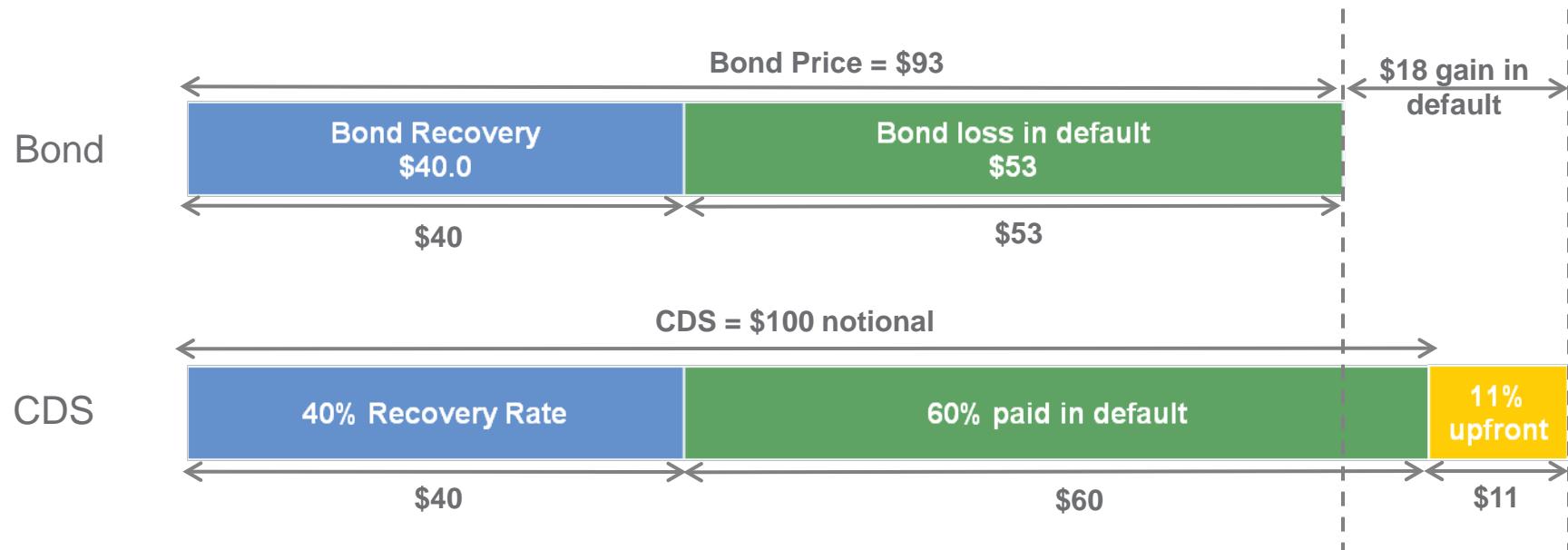
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- Sizing: \$101 if use 100bp contract and \$74.5 if use 500bp contract



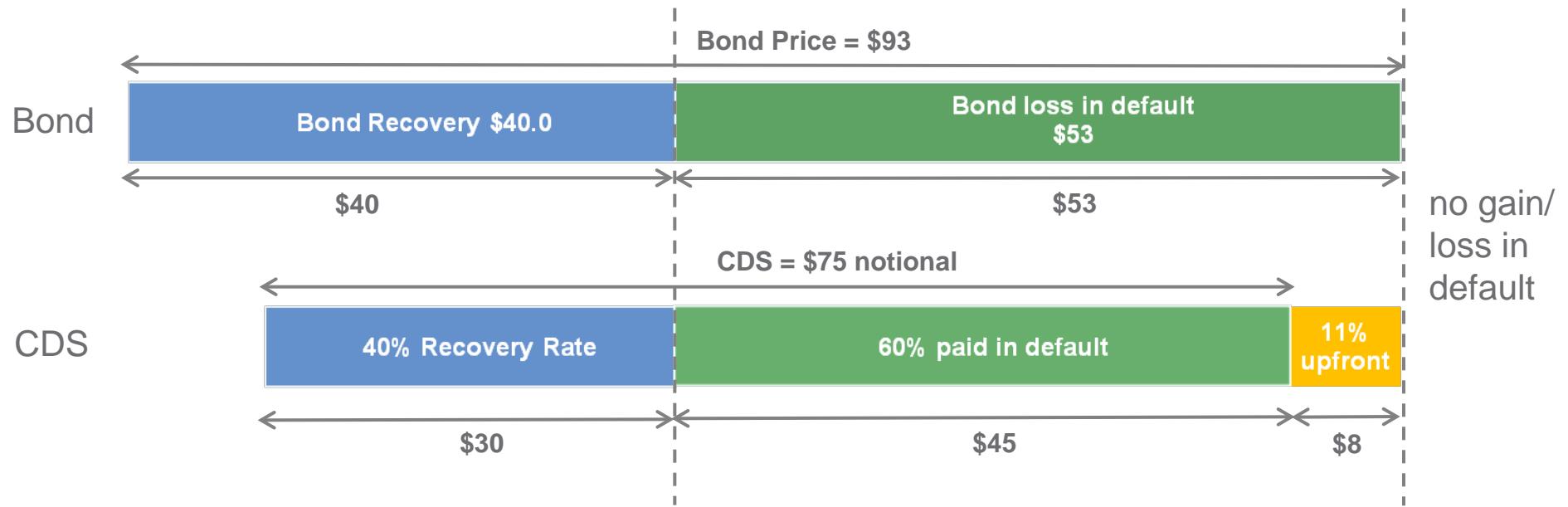
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- Sizing: \$101 if use 100bp contract and \$74.5 if use 500bp contract



Impact of Trade Sizing

- For the same CDS fixed coupon, trade sensitivities can differ because of sizing
- For MAS 4.8% 2015 w/ 500bp cpn CDS; since CDS upfront is negative:
 - Sized equal notional is better in default and if CDS widens short-term
 - Sized for no loss in principal leads to better performance in long term and if bond tightens

		Equal notional	No loss in inst default
		500 Strike	500 Strike
Buy Bond		-\$93.00	-\$93.00
Buy CDS Protection	Notional	\$100.00	\$74.65
	Upfront Payment	\$11.00	\$8.21
Total Cost		-\$82.00	-\$84.79
Gain/Loss if Default	Now	\$18.00	\$0.00
	In 2.5Y	\$17.50	\$2.67
	Just Before Maturity	\$14.01	\$6.06
MtM if CDS Widens	Now	\$5.55	\$4.14
	In 3M	\$6.03	\$5.13
	In 2.5Y	\$13.00	\$17.26
MtM if Bond Tightens	Now	\$4.75	\$4.75
	In 3M	\$5.19	\$5.59
	In 2.5Y	\$13.47	\$15.82
MtM	At Maturity	\$16.91	\$21.00

Source: J.P.Morgan

Note: MtM assumes constant basis just before the CDS widens or bond tightens

Note: Best performing trade is highlighted in blue

Trading CDS vs Bonds - Summary

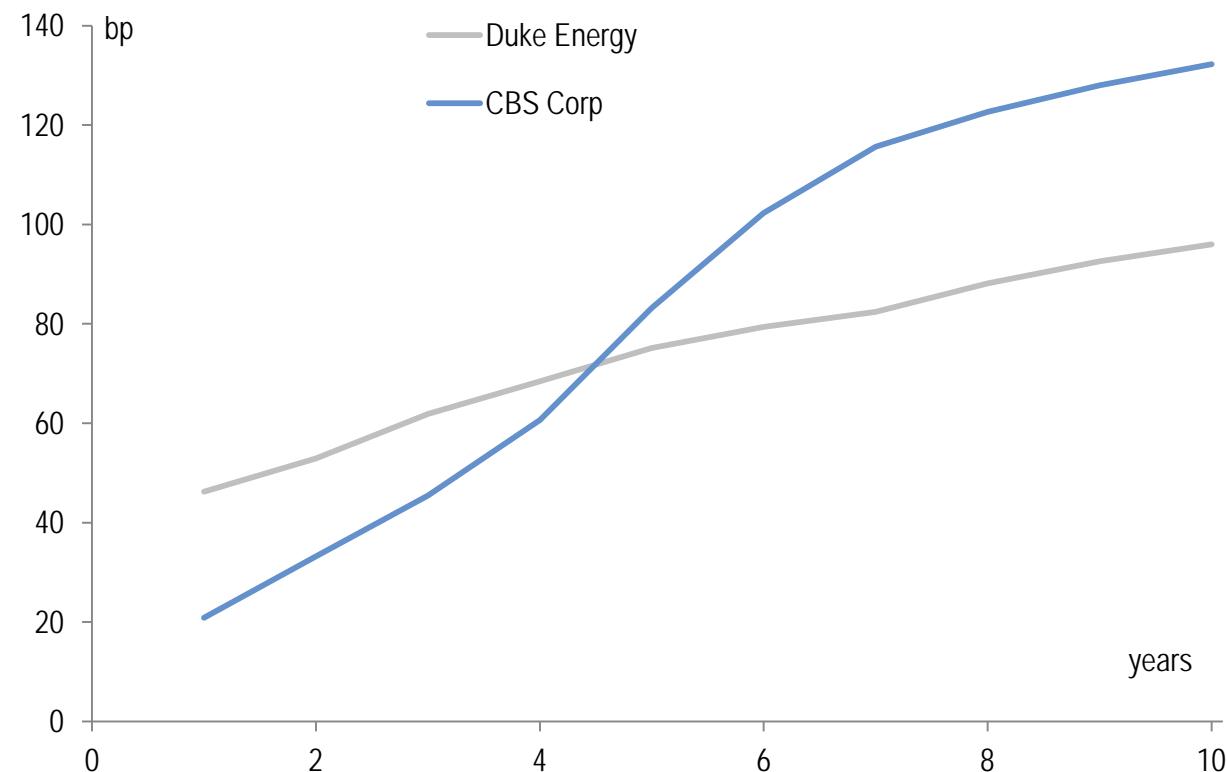
- Trading CDS vs bonds is a popular trading strategy
- Our preferred measure to compare bonds to CDS is bond par equivalent CDS spread (PECS - VCDS <GO>)
- When trading basis, be mindful about
 - Sizing
 - Which fixed coupon to use (if alternative is available)
 - Trade sensitivities
- The main risk in the trade is the mark-to-market if basis moves against the trade, especially with leverage
 - Credit crisis saw basis turn very negative which was an issue for quite a few (levered) investors because of the MtM impact and the ensuing variation margins that had to be posted

Agenda

- Module 1: Overview
 - CDS market overview and update on new market regulations
- Module 2: CDS basics and pricing
 - CDS fundamentals: how contracts work, trading and valuation
 - CDS pricing in more details
- **Module 3: Relative value trading**
 - CDS vs bonds
 - **CDS curves**
- Module 4: Index products
 - CDX indices and iBoxx TRS
 - Index options and index tranches

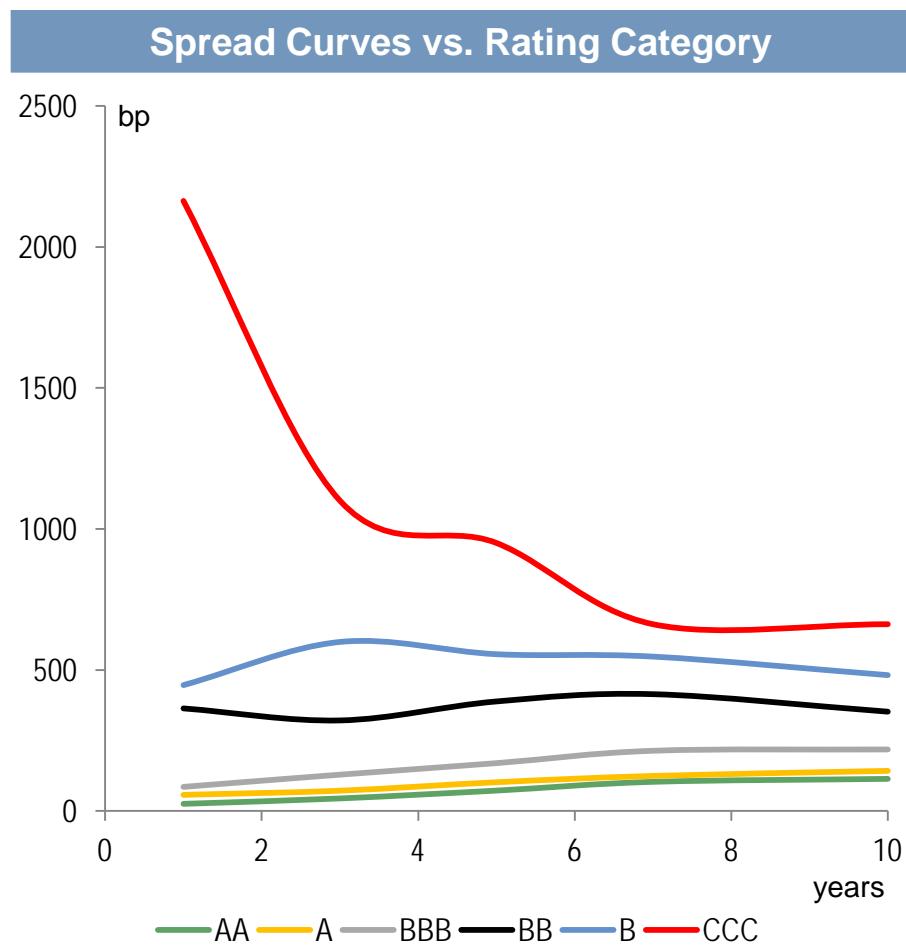
CDS Curve: Credit Risk for Different Maturities

- Credit curve: Bonds and CDS spreads differ for different traded maturities
- Curves can have many shapes: upward/downward sloping, humped...
- Example: CDS curves for Duke Energy and CBS Corp



Source: J.P. Morgan

Curves Steepness and Credit Ratings

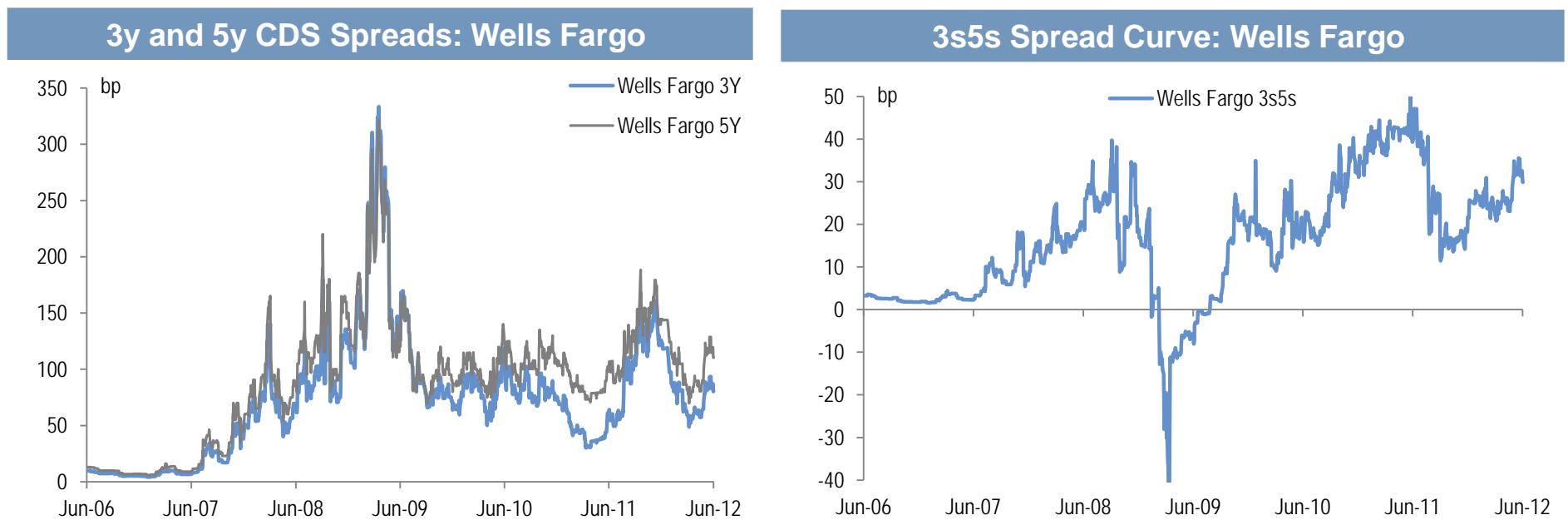


Source: J.P. Morgan

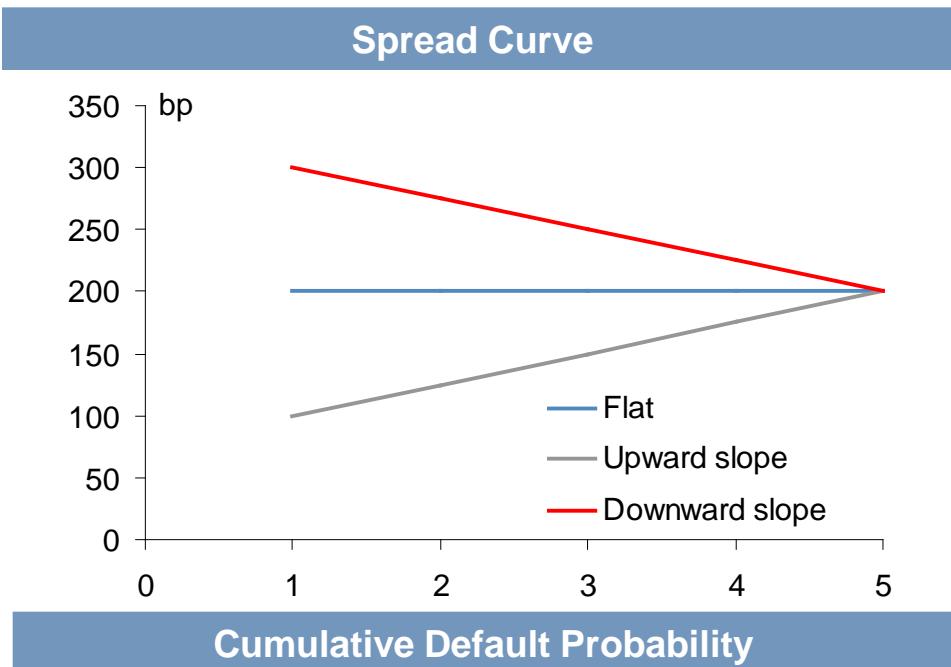
- General empirical rule: The tighter the spread, the steepest the curve
- Credit curves of high-rated companies tend to be upward sloping
- While curves of low-rated companies tend to be downward sloping
- Intuition:
 - High-rated companies are relatively secure in the short term, but uncertainty increases longer-term (e.g. might be downgraded from HG to HY)
 - Low-rated are very risky in the short term, but situation might improve if short-term hurdle is passed

CDS Spread Curves Change Over Time

- Generally, spreads tend not to move in parallel across maturity dates
- The trend is for curves to flatten when the overall spread level widens; and for curves to steepen when the overall spread level tightens
- However, the curve is also affected by technicals. In CDS, the higher liquidity of the 5y point and the lower liquidity of the rest of the curve can affect the shape of the curve and its 'reaction time' to 5y spread changes

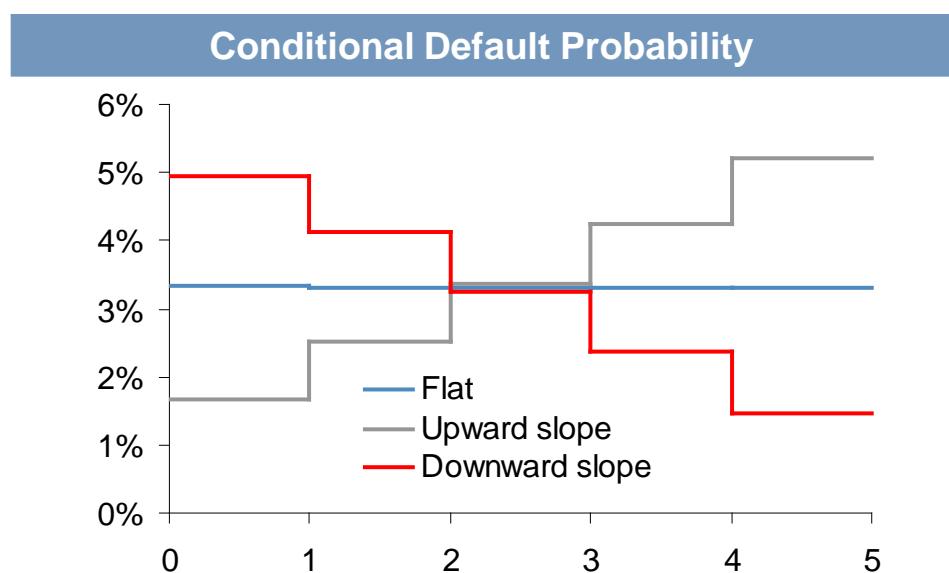
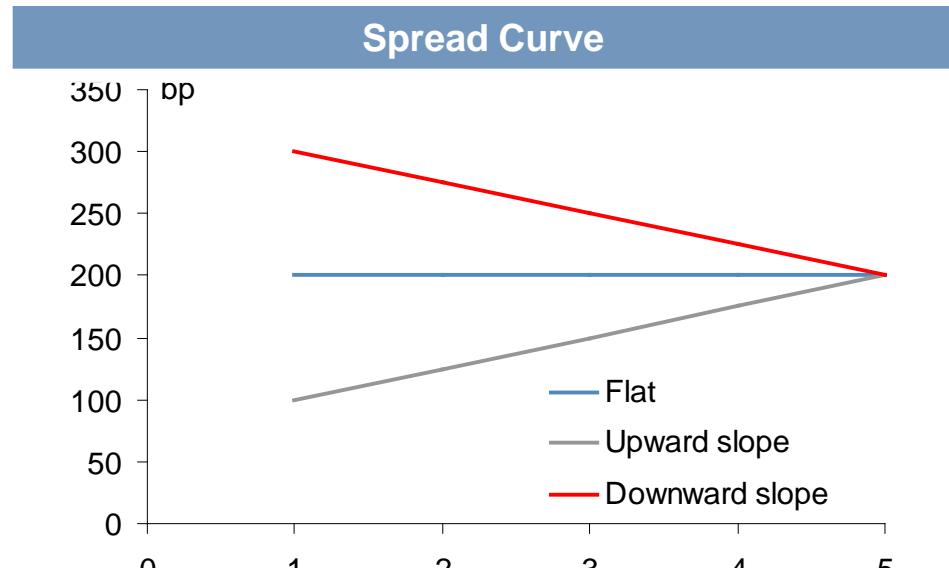


Curve Shape and Default Probability



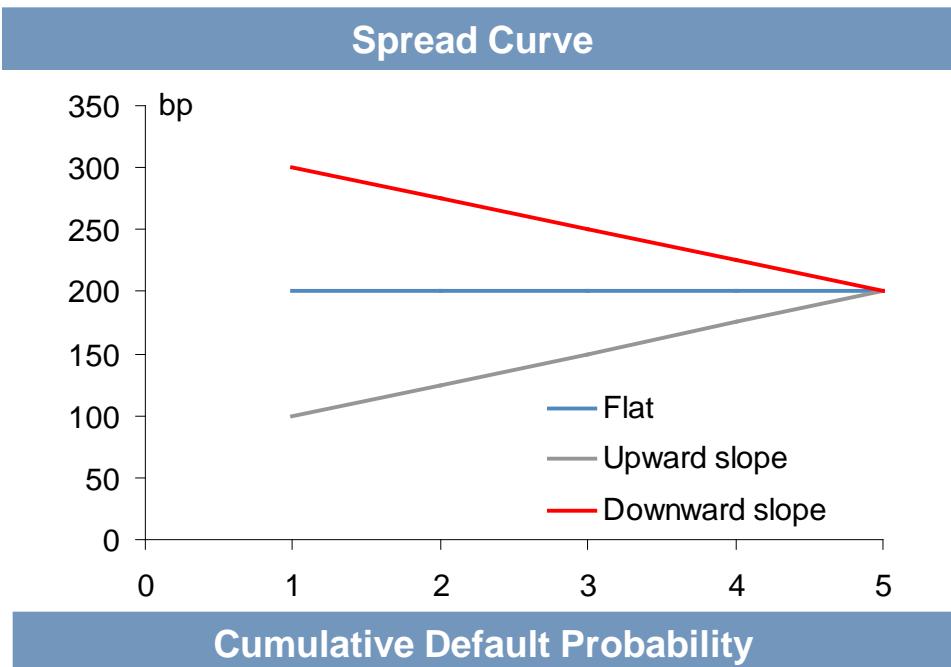
- CDS spread curve can be translated into default prob as a function of time
- Cumulative probability of default never decreases as a fct of time
- For flat curve: Cumulative default probability increases as a fct of time
- Example: 3 curves w/ 5y CDS spread at 200bp
 - Shape of the default probability curve depends on the spread curve
 - Paradox: Downward-sloping curve has the smallest cumulative def prob, even though all curves have same 5y spread

Curve Shape and Conditional Default Probability



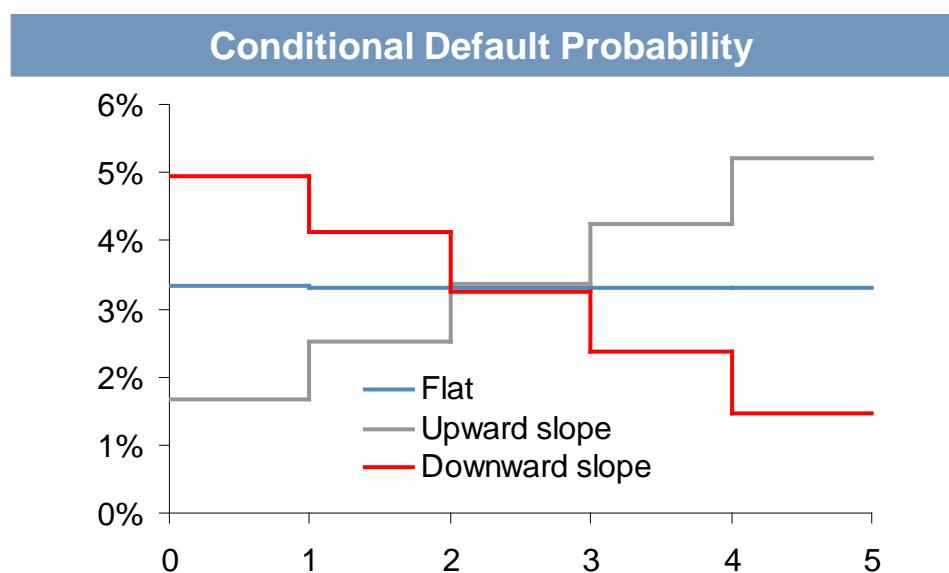
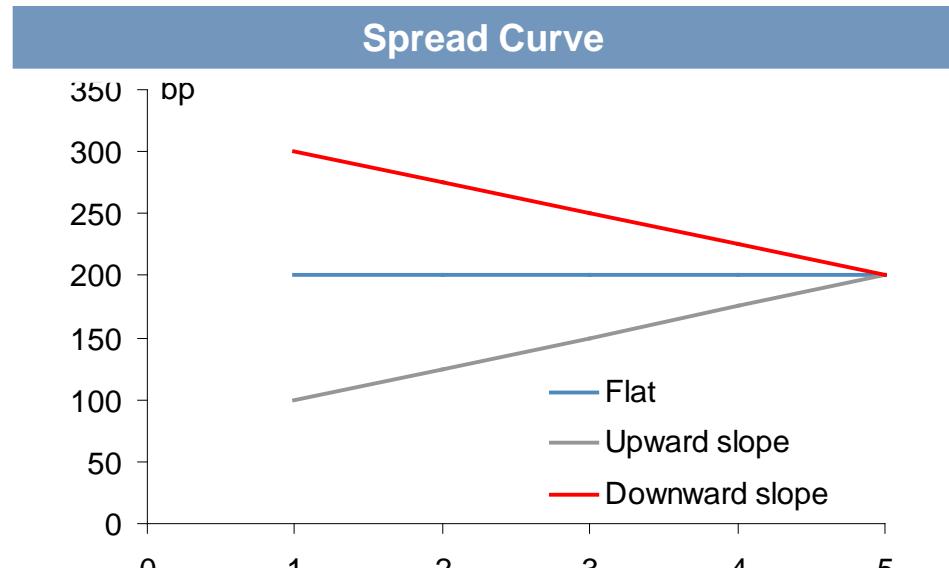
- Conditional default probability: prob. that company will default in year 5, provided it survived the first 4 years
- Conditional default probability increases over time for upward-sloping spread curve and decreases over time for downward-sloping curve
- Therefore, upward-sloping curve means credit deteriorates over time and downward-sloping curve means credit improves over time (if it survives!)
- In line with intuition on curve shape vs credit ratings

Curve Shape and Default Probability



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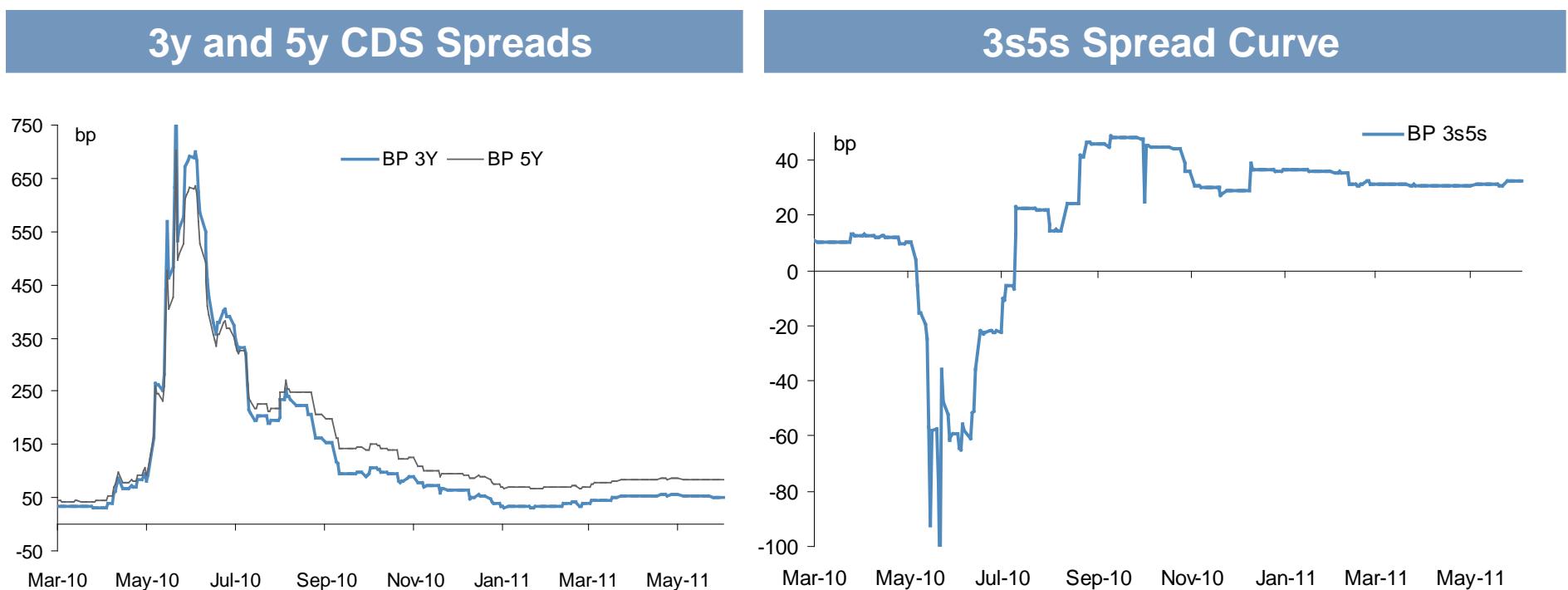
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Example: BP

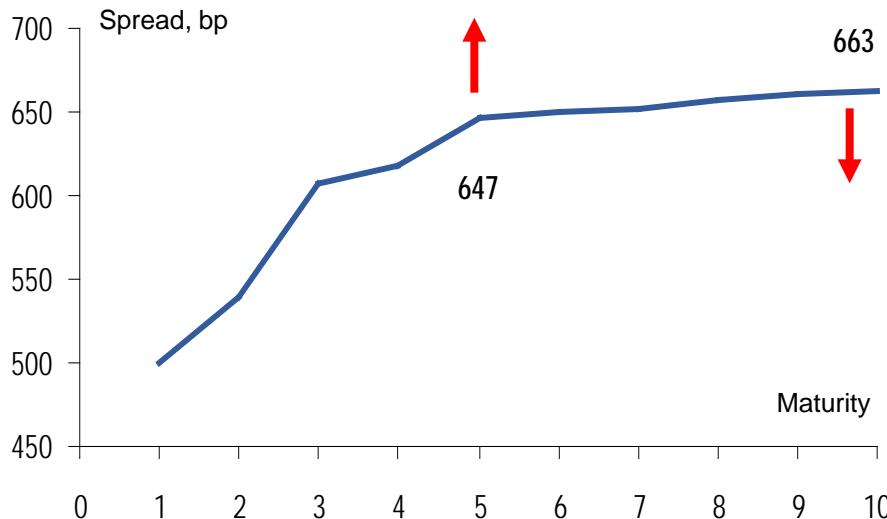
- 20-April-2010: Deepwater Horizon drilling rig explosion (Gulf of Mexico)
- Oil spill closed three months later (August-2010)
- What happened to BP spreads? And curves?



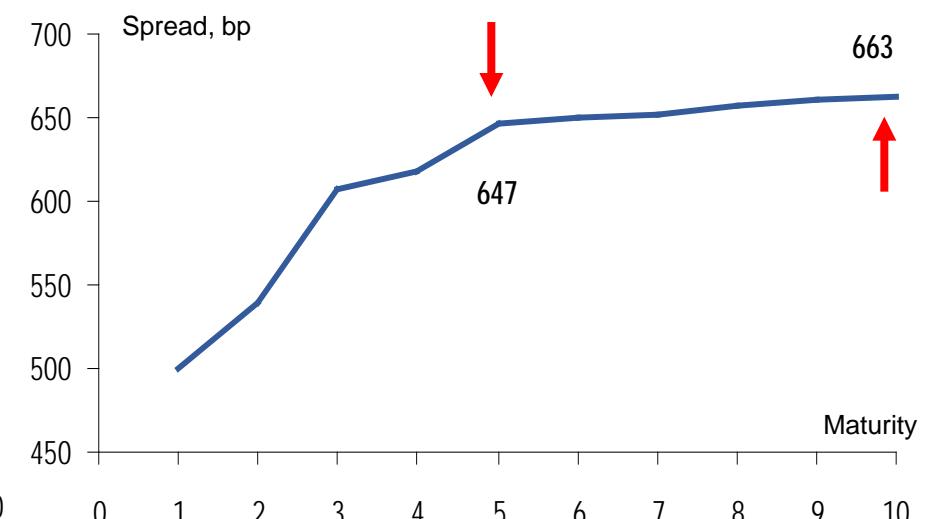
Source: J.P. Morgan

Some Curve Trading Terminology – Flatteners / Steepeners

The 5y / 10y Flattener



The 5y / 10y Steepper



Buy 5y Protection

Sell 10y Protection

Seeks to profit if the 10y tightens *relative to* the 5y,
i.e. curve flattening

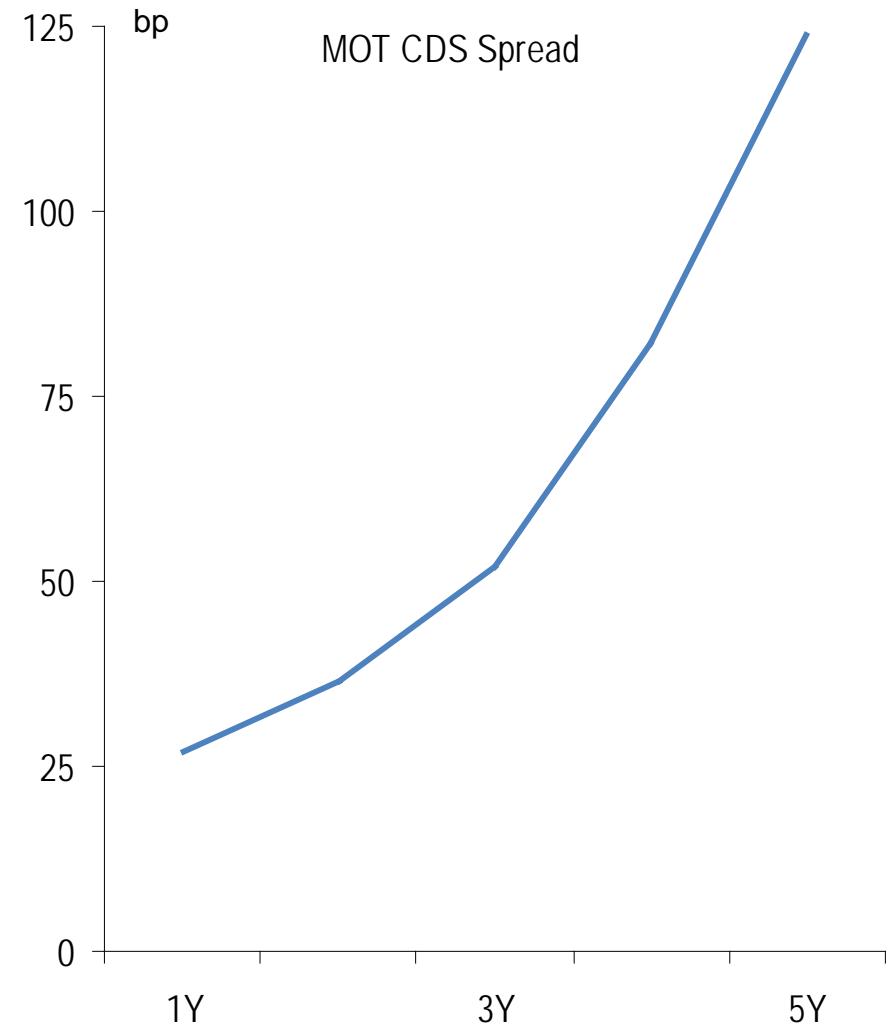
Sell 5y Protection

Buy 10y Protection

Seeks to profit if the 10y widens *relative to* the 5y,
i.e. curve steepening

CDS curve trades

- Take a view on the relative value of spread levels on the credit curve and trading the view that the curve will either flatten or steepen
- Drivers of PnL are
 - Time value: carry and slide
 - Default risk
 - Curve shape
- Attractive curves can be screened using the slope vs spot, forward vs spot and time value
- Example: Motorola CDS curve looked steep to us on January 20, 2011 (trade recommended in our weekly publication)
 - Buy 3y protection and sell 5y protection
 - Gain if 3y widens relative to 5y
 - If view is curve should steepen, then sell 3y protection and buy 5y protection



Source: J.P. Morgan, as of Jan-2011

Isolating the curve shape: Duration-weighted curve trade

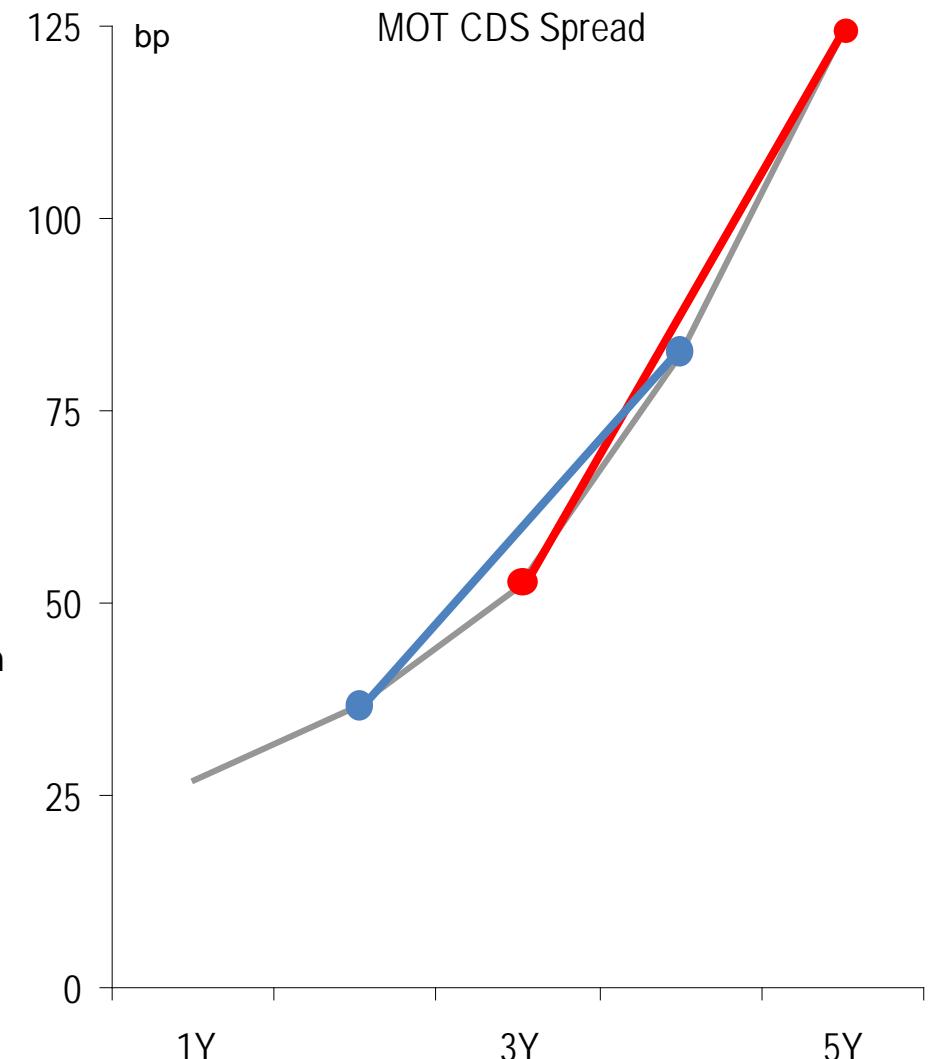
- Trade can be sized differently to get different exposures
- However, to get exposure to the shape of the curve only, then sizing of notional has to be duration weighted
- Example: MOT 3s5s flattener MtM if curve moves in parallel by +10bp immediately
 - Equal notional: If trade is sized 1:1, e.g. \$10mn by \$10mn, trade loses \$17K
 - Duration-weighted notional: If trade is sized duration weighted, e.g. \$16mn by \$10mn, trade is flat

Tenor	Buy 3y	Sell 5y	Net
Notional	-\$10mn	\$10mn	\$0
Spread	52	124	72
Parallel move	+10	+10	72
Duration	2.9	4.6	1.7
Mark-to-Market	\$29K	-\$46K	-\$17K

Tenor	Buy 3y	Sell 5y	Net
Notional	-\$16mn	\$10mn	-\$6mn
Spread	52	124	72
Parallel move	+10	+10	72
Duration	2.9	4.6	1.7
Mark-to-Market	\$46K	-\$46K	\$0

Drivers of PnL of a duration-weighted curve trade

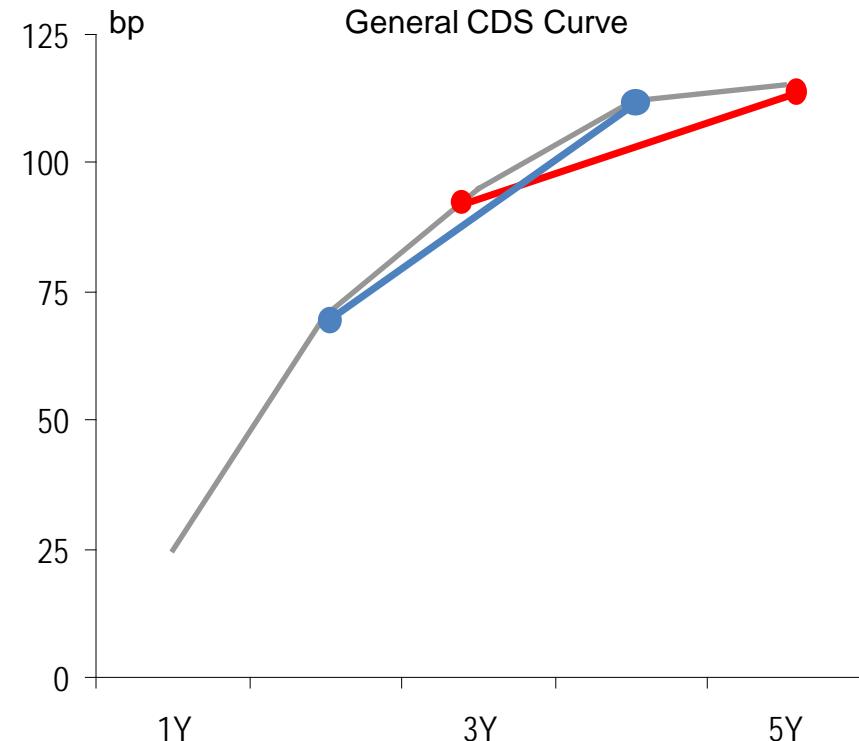
- **Default exposure:** because of different notionalson each tenor
 - MOT: trade gains \$3.6mm if default tomorrow
- **Parallel moves:** duration-weighting insulates from small parallel moves but not the large ones
 - MOT: about \$3K gain if +/-25bp parallel curve move
- **Time: carry and slide**
 - **Carry** is determined by spreads and notionalss
 - MOT: $-52\text{bp} * \$16\text{mn} + 124\text{bp} * \$10\text{mn} = \$41\text{K}$ per year
 - **Slide:**
 - CDS maturity date gets closer as time passes: in 1 year, 3y CDS we bought will really be a 2y CDS
 - If curve stays the same, 3y and 5y CDS spread will slide (i.e. roll down) the curve
 - MOT: 1-year slide makes gains, because the curve flattens as time passes (this is generally not the case)



Source: J.P. Morgan, as of Jan-2011

Usual sensitivities of duration-weighted curve trades

- Generally, duration-weighted curve trades have the sensitivities shown in the table below
- Note that the MOT duration-weighted flattener is exceptional as it offers positive carry+slide
- This normally indicates that the curve is too steep
- The CDS curves can easily be screened to find such opportunities

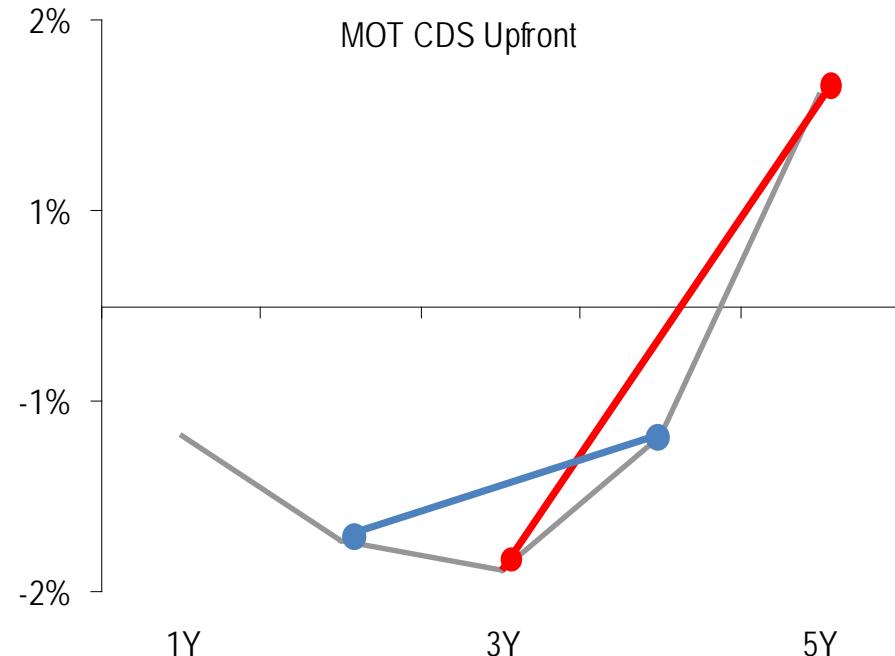


Usual sensitivities of curve trades

	default	large parallel moves	carry + slide
Duration weighted flattener	gains	gains	loses
Duration weighted steepener	loses	loses	gains

Trading in upfront vs trading in par spread terms

- Real trade is executed with fixed coupon, not par spreads
- Impact:
 - **Sizing:** duration depends on the coupon
 - **Carry:** real cash carry comes from the coupons
 - **Slide:** real slide along the upfront curve, not the par spread curve



MOT 3s5s flattener if curve flattens by 15bp, incl bid/ask

Notional	Entry Spread	Entry Upfront	Time Value (3M)			PnL				
			Carry	Slide	Total Time	In Default	Curve -20bp	Curve +20bp	To Target Now	Total PnL in 3m
Motorola										
Sell Prot 5Y	\$2.0mm	124bp	1.11%	\$5K	\$9K	\$14K	-\$1.2mm	\$19K	-\$89K	\$14K
Buy Prot 3Y	\$3.2mm	52bp	-1.39%	-\$8K	\$1K	-\$7K	\$1.9mm	-\$19K	\$90K	\$0K
Net		72bp	\$66K	-\$3K	\$10K	\$7K	\$0.7mm	\$0K	\$1K	\$14K
										\$10K

CDS Curve Trading – Summary

- CDS curve trading to take view on relative value across maturities
- Drivers of PnL:
 - Time value
 - Default risk
 - Curve shape
- Trade sensitivities depend on the coupon

10 MINUTE BREAK

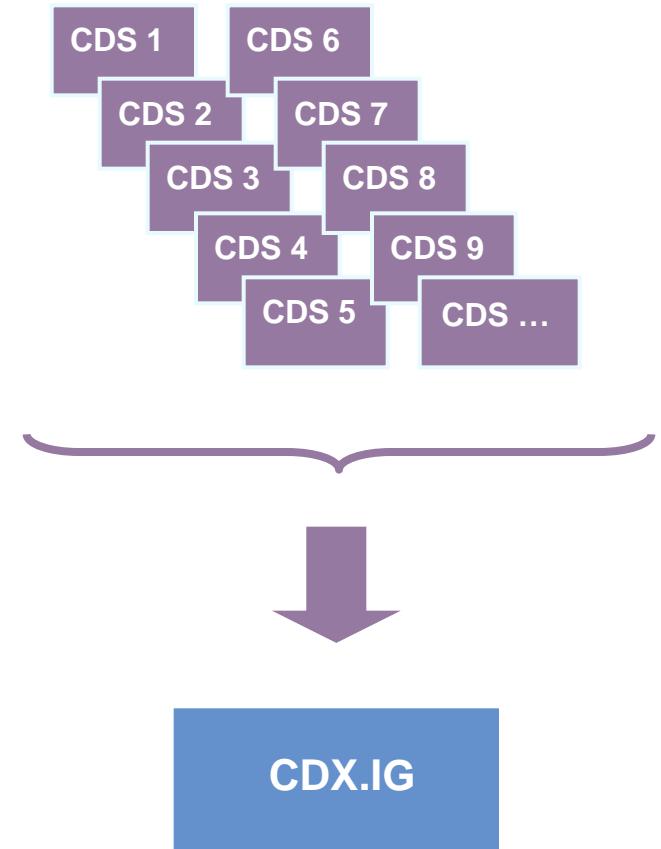
Refreshments outside

Agenda

- Module 1: Overview
 - CDS market overview and update on new market regulations
- Module 2: CDS basics and pricing
 - CDS fundamentals: how contracts work, trading and valuation
 - CDS pricing in more details
- Module 3: Relative value trading
 - CDS vs bonds
 - CDS curves
- **Module 4: Index products**
 - **CDX indices and iBoxx TRS**
 - **Index options and index tranches**

CDS Indices: THE Most Liquid Credit Instruments

- CDX indices allow investors to take diversified long or short exposure to a credit market
- CDX indices are the most liquid instruments in the credit markets
- There are three US indices: CDX.IG, CDX.HY, and LCDX for the High Grade, High Yield, and Loan markets, respectively
- CDX indices reflect the performance of a basket of credits (more precisely a basket of credit default swaps on corporate credits)
- CDX indices have a fixed composition and fixed maturity. New series with an updated basket of underlying credits are launched twice a year (in March and September).



Credit Derivative Indices Across the World

US Indices

- CDX.NA.IG
- CDX.NA.HY
- LCDX
- MCDX

European Indices

- iTraxx Main + Sub Indices
- iTraxx HiVol
- iTraxx Crossover (High Yield)
- SovX West Eur

Asia Indices

- iTraxx Japan + Sub Indices
- iTraxx Asia ex-Japan + Sub Indices
- iTraxx Australia
- SovX Asia/Pac

Emerging Markets Indices

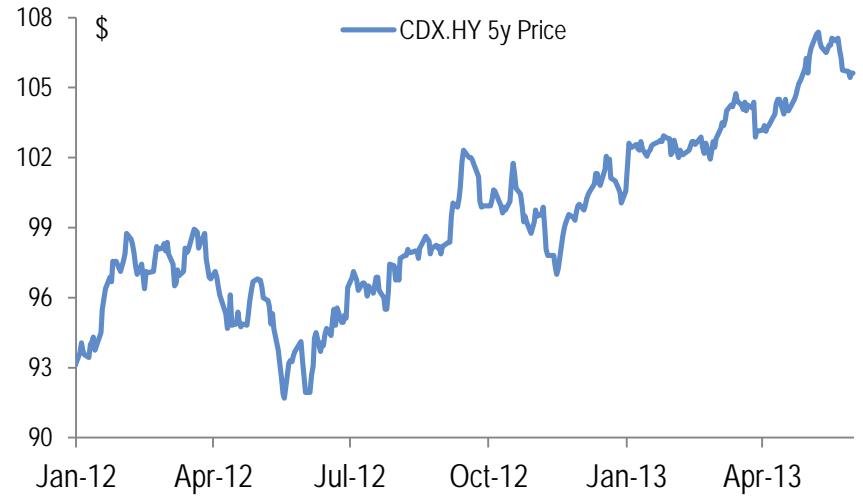
- CDX.EM
- SovX CEEMEA
- CDX LatAm Corp

Recent Trading History of CDX Indices

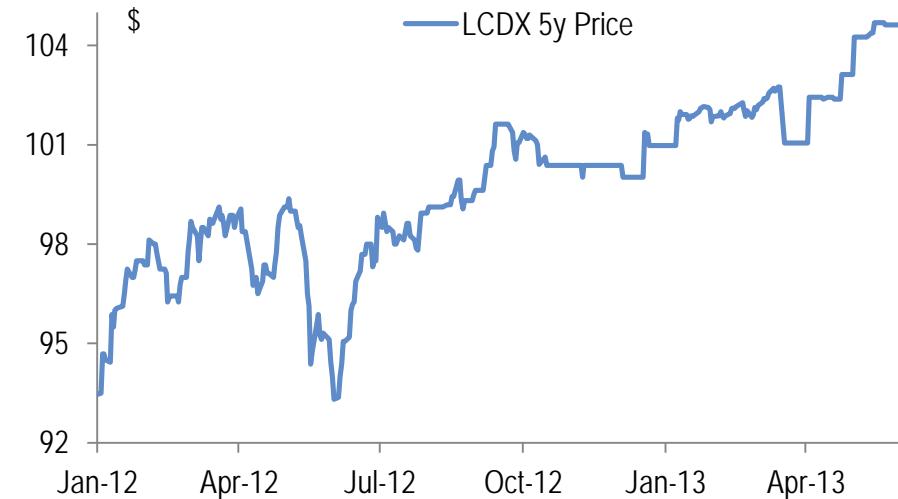
CDX.IG



CDX.HY



LCDX



Source: J.P. Morgan

CDX.IG vs CDX.HY

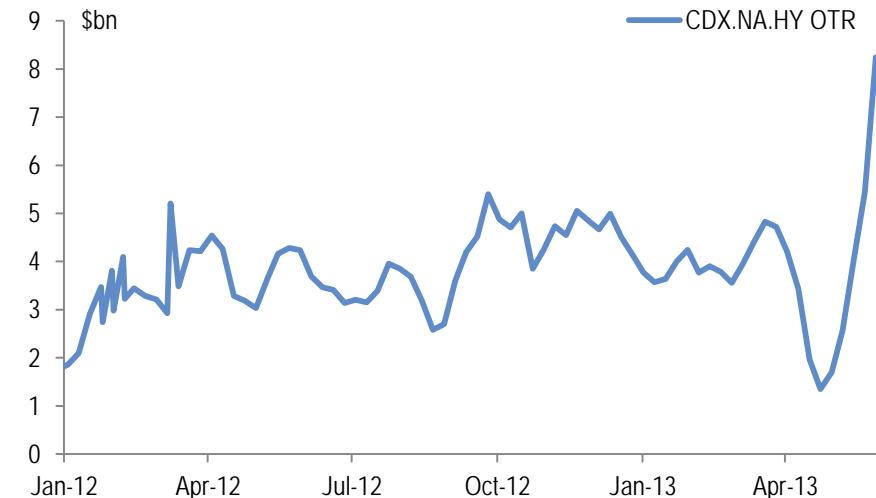


Large Trading Volumes

CDX.IG



CDX.HY



HG Bonds



HY Bonds

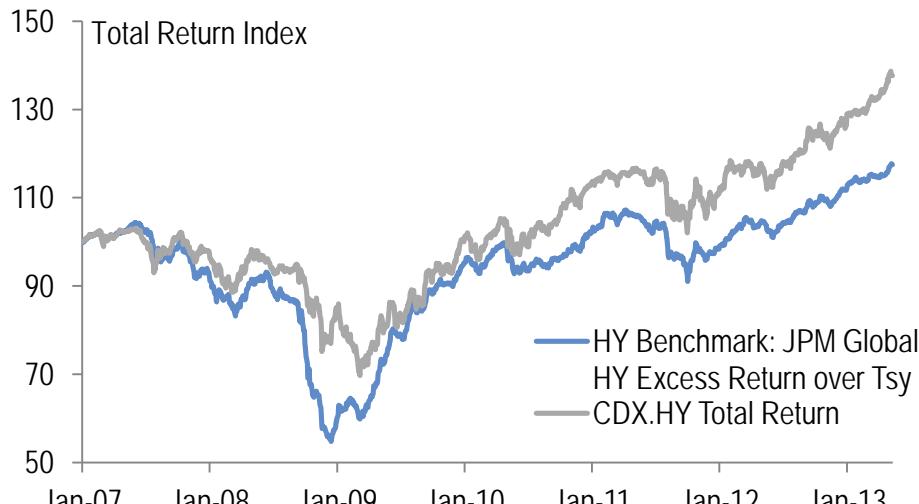


Source: J.P. Morgan

CDX.HY performance vs HY bond benchmark index

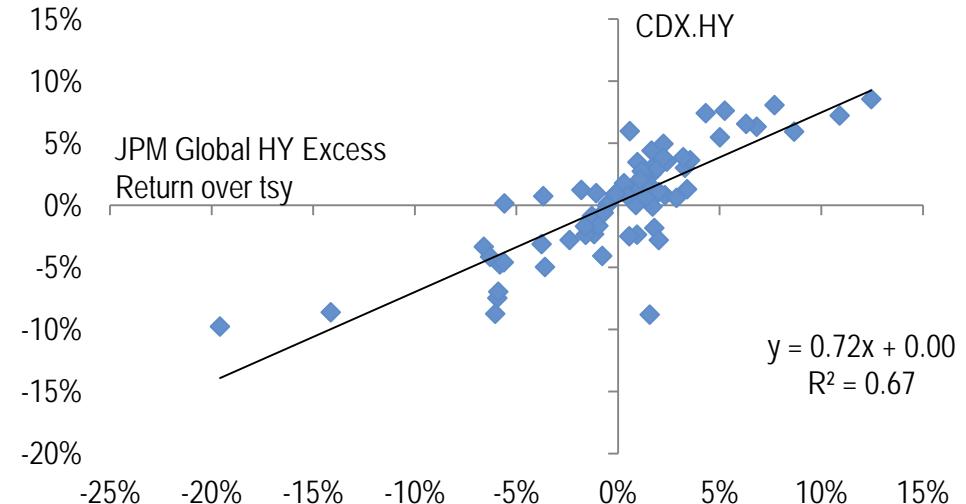
- CDX.HY is often used as a tactical instrument by HY investors to go either long risk or to hedge their structurally long cash bond positions
- However, CDX.HY does not always track the HY bond market very well
 - Only 100 names in CDX.HY portfolio, so specific name risk can impact CDX.HY more than overall HY bond market (as in the last months)
 - CDX.HY composition is not a perfect match for HY bond market in sector, ratings and maturity perspectives
 - Technicals can be different between the two markets, as experienced in 2008-2009
- To reproduce total return on HY cash index, Treasuries returns must be added to CDX.HY returns

CDX.HY vs JPMHY: total return history



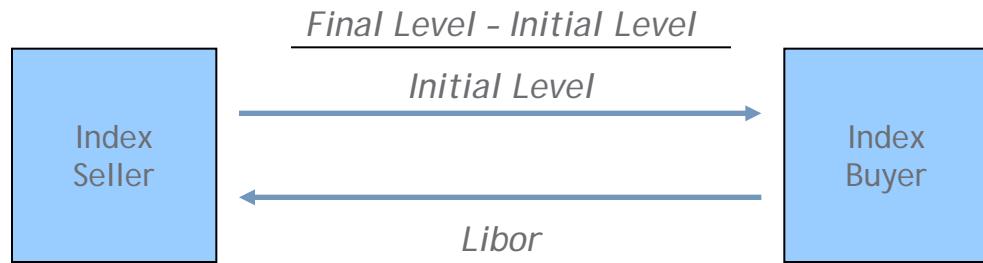
Source: J.P. Morgan

and distribution of monthly returns



Alternative to CDX: iBoxx Total Return Swap (TRS)

Total Return Swap (TRS) payoff



Sample run

JPM CREDIT TRADING - INDEX TRANCES/IBOXX (w) 212-834-2510 (m) 512-785-4453
iBoxx \$ Corp TRS CLOSE - 233.53/234.5 (+2.43)

iBoxx \$ Domestic Corporates BBG Ticker: ICPRDOV Index <GO>
Indicative: Yield 3.80% / Duration 6.76 / Spread 156bps
Last NAV 232.16
Funding: **3m\$Libor flat**

TRS Expiry: Entry Levels:

20-Sep-13 233.53 / 234.5 Mid = 234.02
20-Dec-13 233.57 / 234.64 Mid = 234.1
20-Mar-14 233.6 / 234.78 Mid = 234.19
20-Jun-14 233.63 / 234.93 Mid = 234.28

Live Index page: {JIBX1 <GO>}
Trading desk contacts: Will Haber / Thibault de Romblay / Ryan Li

- iBoxx Total Return Swap (TRS) allows investors to get long and short exposure to the High Grade and High Yield bond markets
- TRS buyer is getting long the total return index and gains if the total return is positive between now and the swap maturity date. He pays 3m LIBOR to the dealer on the notional traded together with an initial collateral. TRS buyer will make money on the principal if the level of the Total Return iBoxx index is above the current level.
- TRS seller is short the index (i.e. pays the index return) and receives LIBOR from the dealer. TRS seller will make money on the principal if the level of the Total Return iBoxx index is below the current level.

iBoxx TRS available on different bond indices: JIBX1<GO>

J.P.Morgan		J.P. Morgan JPM			6) MSG Contributor		17:17:17		
				Zoom			100%		
JP Morgan Chase CBI (JIBX) -> Current Monitor (GDCO 23306 1)									
TRS indicative markets vs. 3m Libor FLAT Funding									
Sep-13 Expiry	Index	Underlying Ticker	Funding	Bid	Offer	Change	Corporate Bond Indices		
1) EUR IG	QW5A	3mEuribor Flat	193.54	194.03	0.45	50.00	11:42		
2) EUR HY	IBOXXMJA	3mEuribor Flat	153.47	154.26	0.73	25.00	11:42		
3) USD IG	ICPRDOV	3m\$Libor Flat	233.37	234.20	2.38		06/13		
4) USD HY	IBOXHY	3m\$Libor Flat	216.97	217.77	2.36		06/13		
5) GBP IG	IYDU	3m£Libor Flat	259.83	260.62	1.40	30.00	11:42		
Dec-13 Expiry	Index	Underlying Ticker	Funding	Bid	Offer	Change	Size(MM) Time		
6) EUR IG	QW5A	3mEuribor Flat	193.34	193.93	0.45	50.00	11:42		
7) EUR HY	IBOXXMJA	3mEuribor Flat	153.42	154.36	0.75	25.00	11:42		
8) USD IG	ICPRDOV	3m\$Libor Flat	233.38	234.36	2.38		06/13		
9) USD HY	IBOXHY	3m\$Libor Flat	216.94	217.93	2.36		06/13		
10) GBP IG	IYDU	3m£Libor Flat	259.80	260.73	1.40	30.00	11:42		
Index buyer pays until Expiry: 3M Libor FLAT									
Index buyer receives at Expiry: Final Level / [Entry Level] - 1									
Page Forward For More									
Trading Desk Contact: +44 207 134 0541 +1-212-834-2510									

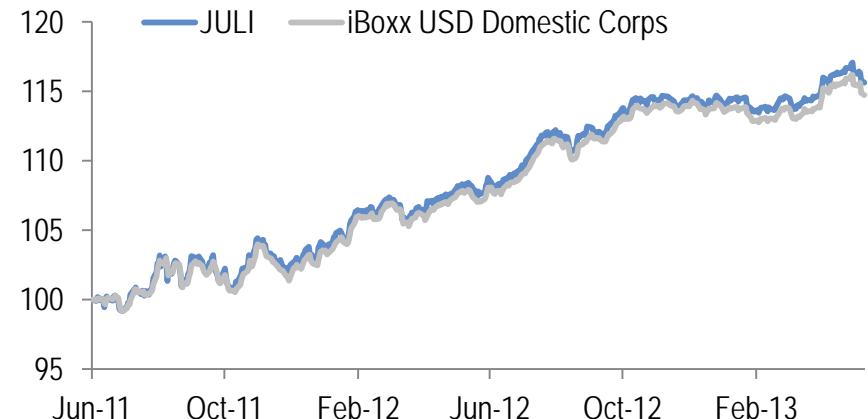
- USD IG: TRS is based on the total return of the Markit's iBoxx USD Domestic Corp Bond index
- USD HY: TRS is based on Markit's iBoxx USD Liquid HY index

iBoxx vs HG and HY corporate indices

The iBoxx USD Domestic Corps Index is similar in composition to our JULI index

	iBoxx USD Domestic Corps	JULI Ex-EM
Size	\$2.5tn	\$3.0tn
# bonds	2500	3800
# issuers	441	580
Largest Issuer	JPM	JPM
% of 10 largest issuers	23%	19%

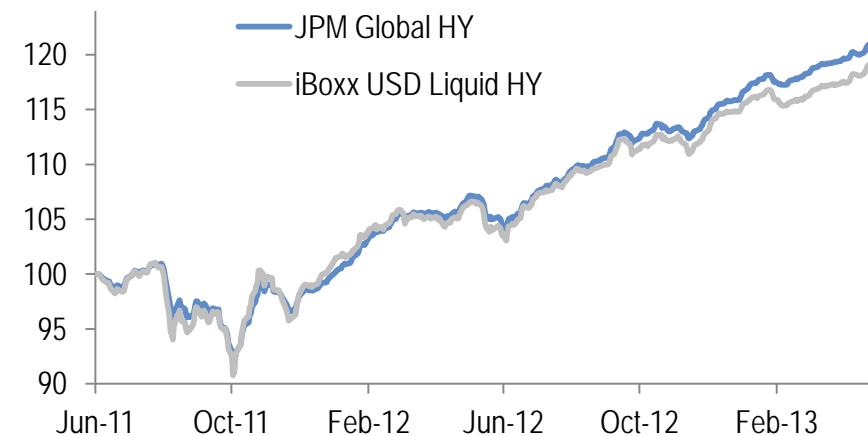
iBoxx and benchmark performances for HG



The iBoxx USD Liquid HY index is somewhat similar to our HY corporate index

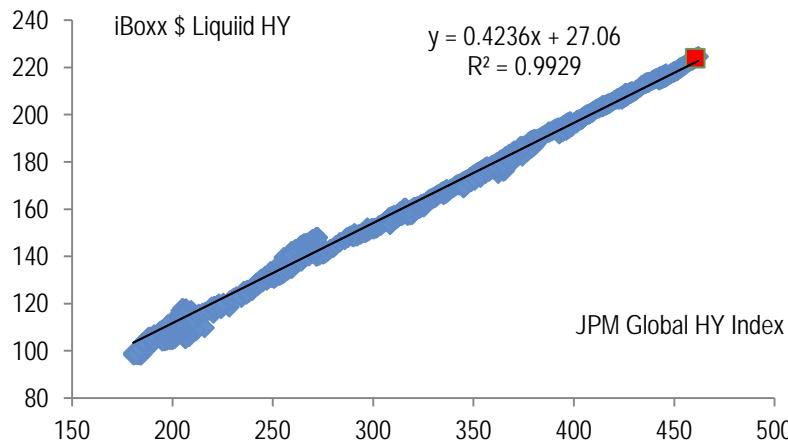
	iBoxx USD Liq HY index	JPM Global HY Index
Size	\$565bn	\$866bn
# bonds	688	1724
# issuers	246	1219
Largest Issuer	AIG	REYNOL
% of 10 largest issuers	22%	5%

iBoxx and benchmark performances for HY



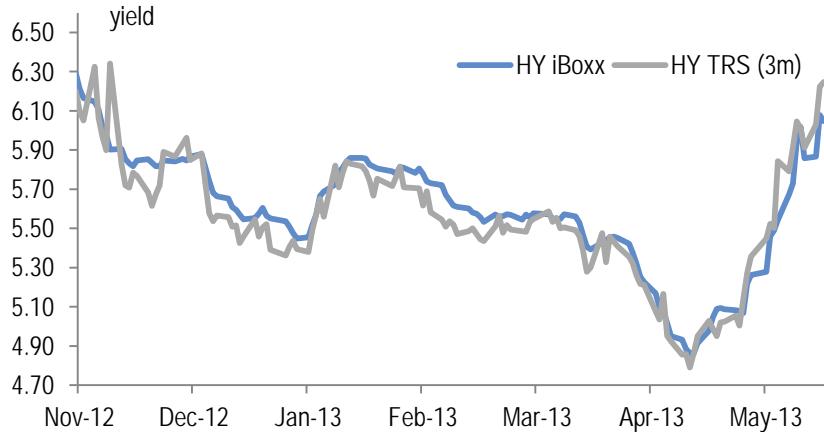
Performance vs comparable products

iBoxx matches traditional corporate bond total return benchmarks (6y regression)



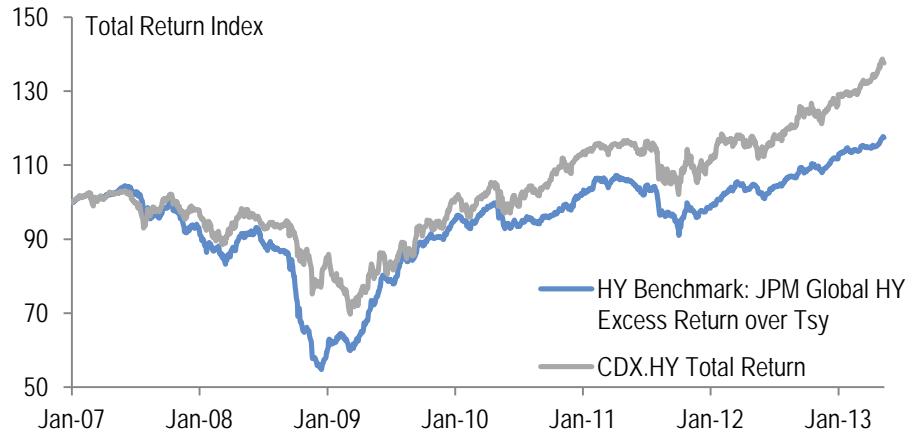
- iBoxx Total Return Index closely matches traditional benchmark total return indices, much better than CDX
- iBoxx TRS economic and trading costs look competitive to other alternatives, but its bid/ask is larger than for CDX
- iBoxx TRS allows investors to be exposed to the whole credit curve, whereas credit derivatives offer a maximum of 10y exposure
- HG TRS provides investors with exposure to all the Banks, CDX.IG does not
- However, iBoxx TRS is less liquid than CDX

HY TRS has been trading close to its NAV



Source: Bloomberg and J.P. Morgan

While CDX.HY and bonds total returns do not always match



CDX Indices, iBoxx TRS, Options and Tranches

- CDX indices
 - Description and trading conventions for the US indices
- iBoxx TRS
 - Description and trading conventions
 - A potential competitor to CDX
- Relative value trades
 - Index basis, curve, roll, and cross-index
 - Example: CDX.IG vs S&P 500
- Options on CDX Indices
 - Brief introduction
 - Popular ways to trade options
- Tranches on CDX Indices
 - Brief introduction and use
 - Trading formats and volumes

US CDX Indices in More Details

- US Corp CDX indices point to different portfolios that reflect different markets
- Like single-name CDS, CDX indices trade with fixed coupon and upfront
- Quotes: CDX.IG in spread terms; CDX.HY and LCDX in bond price terms
 - For example, CDX.HY: \$103.5 quoted price means investors who buys \$100mn protection will receive \$3.5mn upfront and pay \$5mn per year in coupon
 - Convention: “buy the index” = buy prot. in CDX.IG, but sell prot. in CDX.HY
- Most liquid index is CDX.IG, followed by CDX.HY
- CDX indices have several tenors. The most liquid index is the 5y.

Index	No. of entities	Selection criteria	Coupon	Assumed rec. rate	Quoting	Typical Bid / Ask	Avg volume per day	Typical trade size	Traded tenors
CDX.IG	125	Liquid IG corp CDS	100bp	40%	Spread	0.5bp	\$20bn	\$100mn	3, 5, 7, 10y
CDX.HY	100	Liquid HY corp CDS	500bp	30%	Price	\$0.125	\$4bn	\$50mn	3, 5, 7y
LCDX	100	Liquid corp Loan CDS	250bp	70%	Price	\$0.25	\$1bn	\$25mn	5y

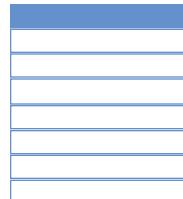
Bloomberg screen for CDS Indices: {CDX <GO>}

Markit Indices	Spread	Change	Spread	Basis	Roll	Data Range		Spread		1 Week	
						Low	Range	High	Avg	+/-	1W Chg
1) Americas											
10) CDX Investment Grade	83.91	+1.74		2.9	9.5	81.0	81.0 - 87.5	87.5	84.0	-0.1	+0.0
11) CDX High Yield	103.72*	-0.31		-0.6	1.3	102.8	102.8 - 104.2	104.2	103.6	+0.2	-0.2
12) MCDX	127.42	+6.09		N.A.	N.A.	119.0	119.0 - 127.4	127.4	120.0	+7.5	+7.9
13) CDX Latin America				N.A.	N.A.	N.A.		N.A.	N.A.	N.A.	N.A.
2) EMEA											
21) iTraxx Europe	109.58	-3.36		3.4	9.3	104.3	104.3 - 112.9	112.9	110.1	-0.6	-3.2
22) iTraxx HVOL	161.52	-6.31		3.7	13.0	158.7	158.7 - 168.8	168.8	164.8	-3.3	-4.3
23) iTraxx Crossover	451.69	-19.25		2.0	63.9	436.1	436.1 - 475.6	475.6	461.1	-9.4	-18.6
24) iTraxx Sr Financial	159.65	-4.75		5.1	13.3	152.3	152.3 - 164.6	164.6	160.8	-1.1	-5.0
25) iTraxx Sub Financial	235.41	-9.48		2.1	20.3	220.8	220.8 - 244.9	244.9	234.5	+1.0	-0.4
26) iTraxx Corp CEEMEA	256.68	-17.81		N.A.	N.A.	256.7	256.7 - 284.8	284.8	270.8	-14.2	-11.9
27) iTraxx SOVX W Europe	90.15	-0.01		-0.6	-34.7	87.7	87.7 - 90.2	90.2	89.3	+0.9	+0.0
28) iTraxx SOVX CEEMEA	216.06	-4.18		22.5	25.1	188.9	188.9 - 221.8	221.8	202.5	+13.6	+27.2
3) Asia											
32) iTraxx Japan	106.01	-4.30		3.6	-4.0	93.2	93.2 - 110.3	110.3	99.9	+6.1	+8.6
33) iTraxx Asia Ex Japan IG	135.07	-12.25		11.8	N.A.	128.5	128.5 - 147.3	147.3	135.8	-0.7	+6.6
34) iTraxx Australia	125.95	-7.79		7.3	14.5	120.2	120.2 - 133.7	133.7	125.6	+0.4	+1.9
Emerging Markets											
36) CDX Emerging Market	109.12*	+0.16		1.7	-0.8	107.0	107.0 - 109.1	109.1	108.2	+0.9	+0.3

CDX Indices: What happens in a Credit Event?

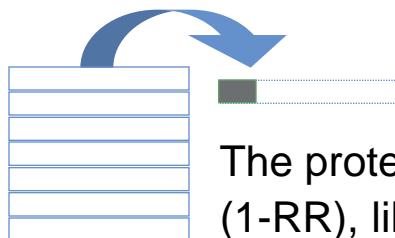
- Two credit events: Bankruptcy & Failure to pay for US
- A CDX position can be considered as a series of single-name credit default swaps on each of the names composing the index
- Example
 - X buys \$100 million of CDX.HY protection (100 names); equivalent to \$1 million protection on each of the names composing the index
 - If there is a Credit Event on one of the names composing the index, the contract will be triggered on that name
 - Assuming a recovery rate of 30%, the protection buyer will receive $(1-R) * \$1 \text{ million}$, or \$700k
 - Coupons will be paid on the full notional until the credit event date, and on the reduced notional afterwards

- ① Credit Event on one of the names



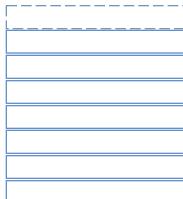
The protection buyer and the protection seller can trigger the contract

- ② The triggered name is stripped out of the contract and physically settled; unless individual credit position $< \$50,000$, in which case it is cash settled



The protection buyer will receive $(1-RR)$, like a normal CDS

- ③ The contract remains live on a reduced notional



Premium is paid or received on a reduced notional

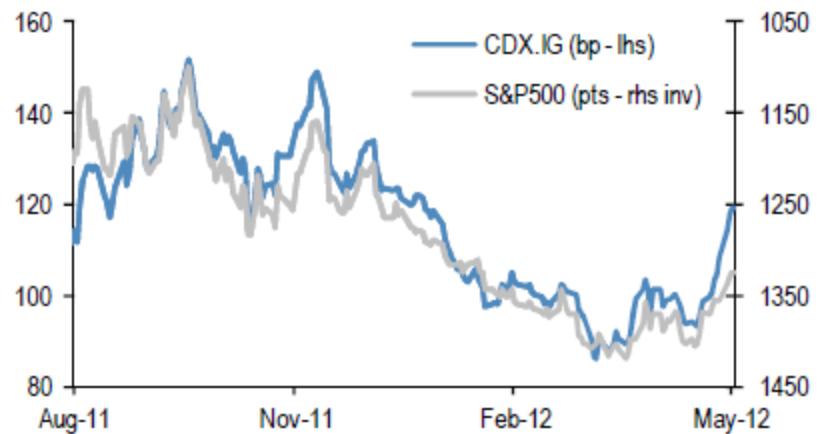
Relative Value Trades

- CDX indices allow investors to take relative value views across different dimensions: time, portfolios and markets
- The four most popular relative value trades: index basis, curve, roll, and cross-index
- **Cross-index trades:** relative value between different markets
 - Example: CDX.IG vs S&P 500, CDX.HY vs VIX, CDX.IG vs CDX.HY, or CDX.HY vs LCDX
- **Curve trades:** relative value across the tenors of a single index
 - Example: 3s5s CDX.HY on-the-run duration-weighted flattener
- **Roll trades:** relative value across different Series of the same index family
 - Example: Buy protection CDX.HY Series 17 5y and sell protection CDX.HY Series 16 5y
- **Index basis trades:** trading the index vs the underlying single-name CDS in the portfolio
 - Example: Buy CDX.HY Series 17 5y protection and sell 5y protection on the 96 single-name CDS in the Series 17 basket

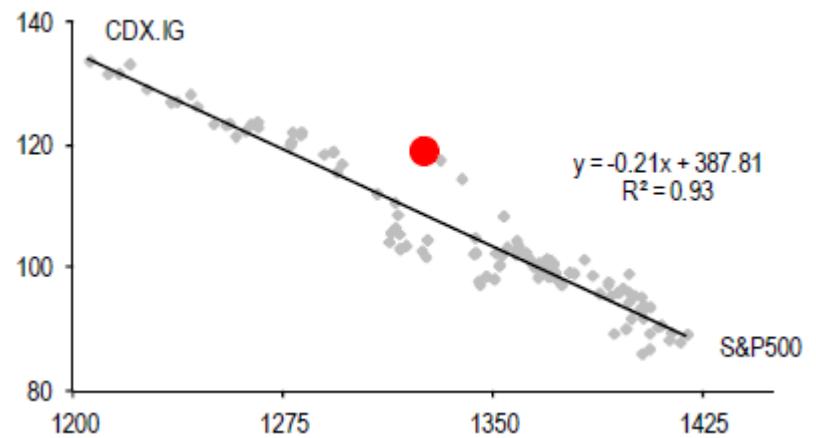
Cross-Indices Trades

- The indices are attractive for cross-market trades
 - Credit vs equity: CDX vs S&P 500
 - High Grade vs High Yield: CDX.IG vs CDX.HY
 - Bonds vs loans: CDX.HY vs LCDX
- Example: Sell CDX.IG protection and short S&P 500 in a 6.5:1 ratio (recommended 5/16/12)
 - In mid-2012, CDX.IG underperformed too much and thus looked too wide vs S&P 500
 - CDX.IG looked about 7bp too wide vs S&P 500, 2.5 std dev
 - European risks driving the market but no credit-specific developments, hence both S&P 500 and CDX.IG should trade in line
 - Recommend selling \$100mm CDX.IG protection and shorting 230 S&P Eminis, i.e. long risk CDX.IG vs. short risk S&P 500 in a 6.5:1 ratio

Mid 2012: Equities outperformed CDX.IG



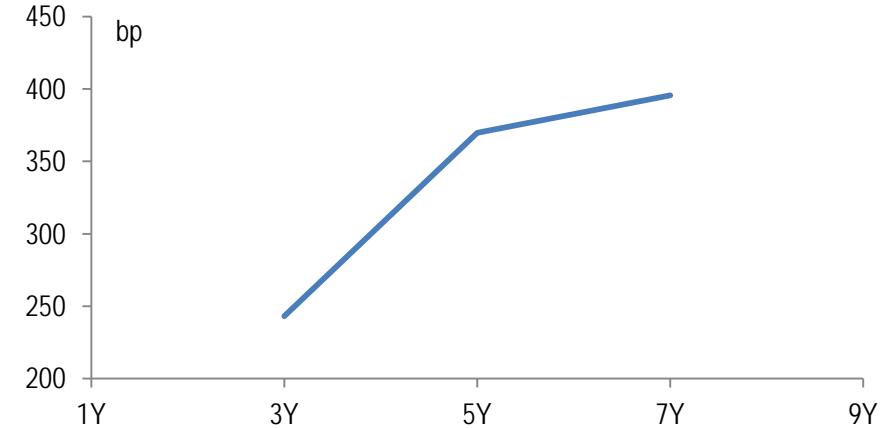
...and CDX.IG seemed wide vs. S&P



Curve Trades

- Curve trading: taking a view on the relative value of spread levels on the credit curve and trading the view that the curve will either flatten or steepen
- Drivers of PnL are
 - Time value: carry and slide
 - Default risk
 - Curve shape
- Attractive curves can be screened using the slope vs spot, forward vs spot and time value
- Example: CDX.HY 3s5s looks steep
 - Buy 3y protection and sell 5y protection
 - Gain if 3y widens relative to 5y
 - If view is curve should steepen, then sell 3y protection and buy 5y protection

CDX.HY curve in early June



Historical 3s5s in CDX.HY

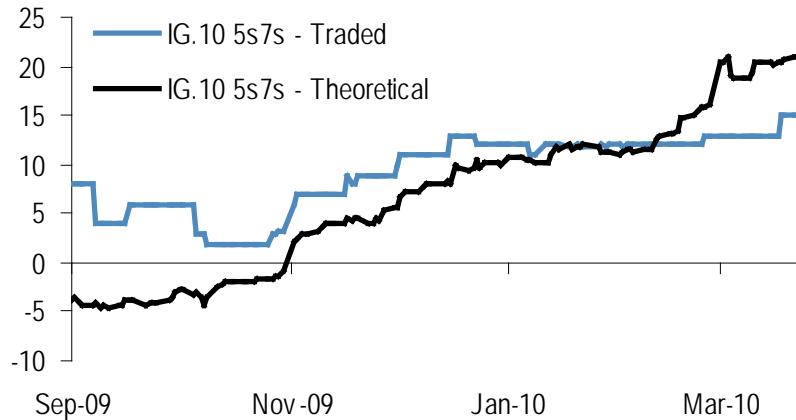


Source: J.P. Morgan, as of 18-Jun-2012

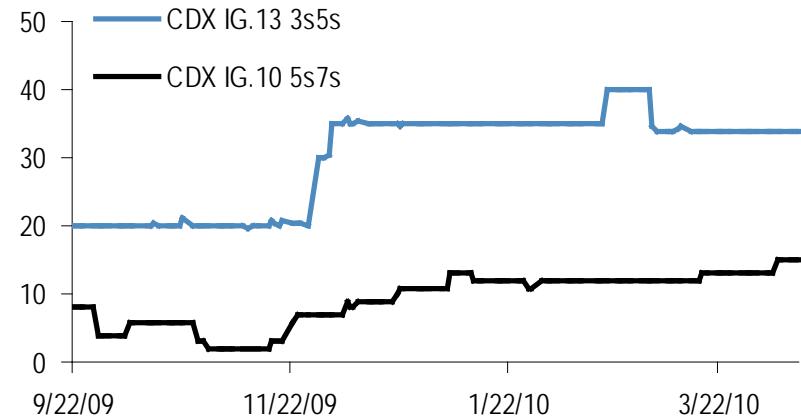
Trade example: CDX.IG Series10 5s7s steepener in 2010

- CDX.IG curves had moved significantly in early 2010, but some curves were lagging
- CDX.IG S10 looked too flat and duration-weighted steepener looked attractive

CDX.IG S10 5s7s looked flat vs theoretical



and flat vs similar curves



- Trade recommendation on April 12: CDX.IG S10 5s7s duration-weighted steepener. Sell \$15mn CDX.IG S10 protection at 93bp and buy \$10mn CDX.IG S10 7y at 108bp.
- Trade worked: could exit on September 30 with a \$41K gain (7% ROI / 17% IRR)

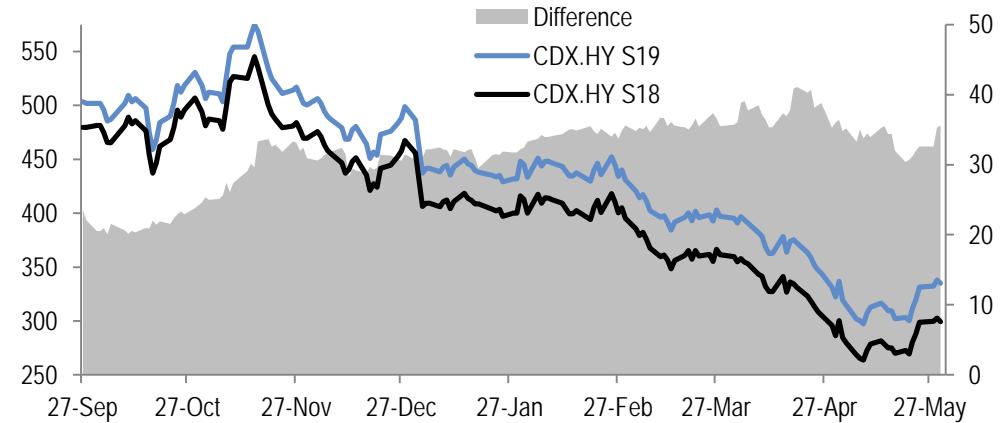
Roll Trades

- As new CDX index Series are launched every 6 months, off-the-run Series still trade (even though liquidity tends to be larger in the more recent Series)
- The differences between Series are
 - Composition of the portfolio
 - Maturity date
- Investors who have a view between the portfolios can trade one Series vs another
- Two ways to implement the trade
 - Same maturity date
 - Example: CDX.HY S19 3y vs S15 5y, which both mature in December 2015
 - Same tenor
 - Example: CDX.HY S19 5y vs S18 5y
 - Note that this is also a curve trade

Difference between S18 and S19

Series 19	5Y CDS (bp)	Series 18	5Y CDS (bp)
CIT Group Inc.	280	Residential Cap	Defaulted
CCO Holdings	318	Ford Motor Co	237
Calpine Corp	370	Pioneer Natural	139
Average			188

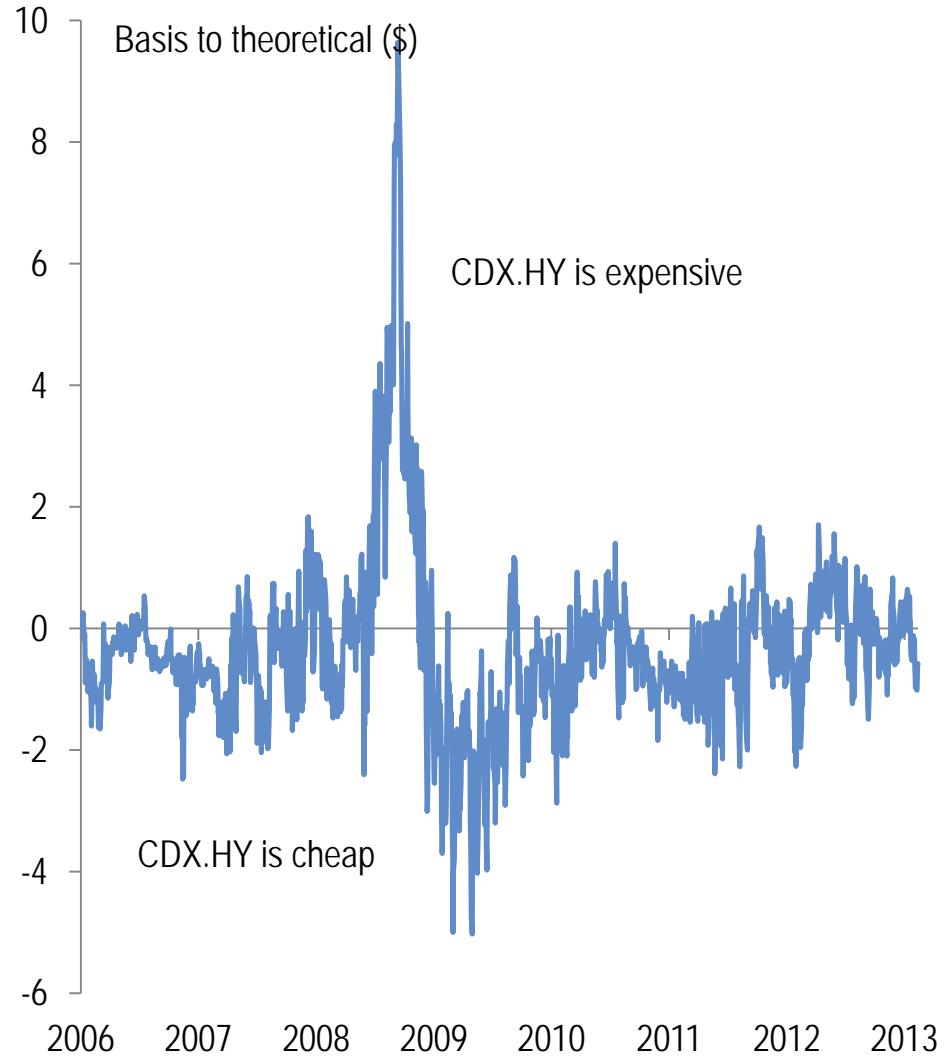
CDX.HY S19 has traded wider to S18 since inception



Source: J.P. Morgan

Index Basis Trades

- CDX Indices can be compared to closed-end mutual funds
- NAV is the theoretical value implied by the underlying CDS in the portfolio
- Index can trade cheap/expensive compared to its underlying
- Drivers of basis to theoretical values:
 - Liquidity: When the market is volatile, the index adjusts faster than the 100 underlying CDS
 - Hedging bias: Index is more commonly used as a hedge against a market decline, so it tends to trade cheap to theoretical value
- When the basis is large, trading index vs underlying CDS can be attractive



CDX Indices, iBoxx TRS, Options and Tranches

- CDX indices
 - Description and trading conventions for the US indices
- iBoxx TRS
 - Description and trading conventions
 - A potential competitor to CDX
- Relative value trades
 - Index basis, curve, roll, and cross-index
 - Example: CDX.IG vs S&P500
- Options on CDX Indices
 - Brief introduction
 - Popular ways to trade options
- Tranches on CDX Indices
 - Brief introduction and use
 - Trading formats and volumes

How Options Can Be Used

Directional Views on spread

- Options can be used to take directional views on spread in the same way as taking an outright long/short position on CDX / iTraxx
- Buying options will limit the downside of opposing view materialising
- Selling options provides premium for small directional views

Volatility View

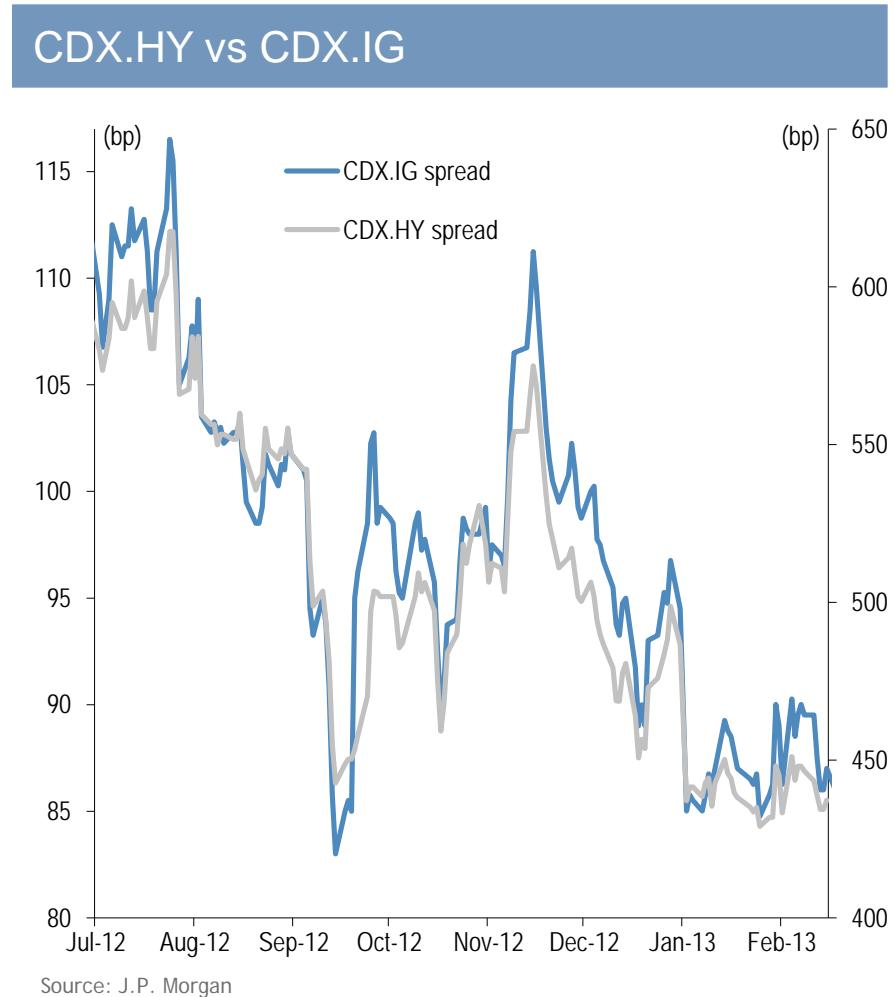
- Buying or selling options on CDX / iTraxx are efficient ways of monetizing a view on volatility
- Buy options to express a high volatility view
- Sell options to express a low volatility view

Credit Options: Some Definitions

- Call: option to buy risk—sell protection (receiver option)
- Put: option to sell risk—buy protection (payer option)
- Premium: cost of the option (in cents), paid upfront
 - Cents = Basis Points × Duration
- At-The-Money Strike Price (Spread) is the Forward spread
- Options Exercise
 - All our credit options are European: can be exercised only on the expiration date
 - On expiry date from 9 a.m. to 11 a.m. for US and 9 a.m. to 4 p.m. (UK time, for Europe)
 - Can also be assigned/unwound before expiry to monetize value

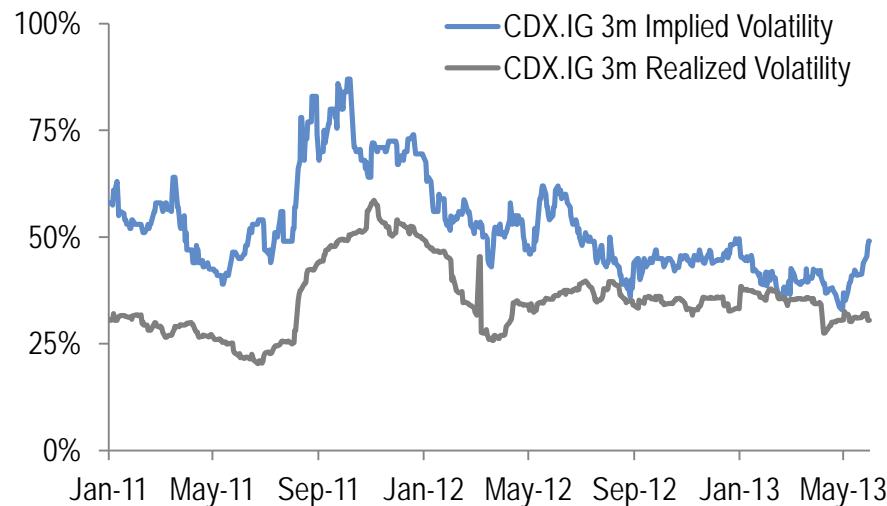
Trade example: Long CDX.IG vs short CDX.HY using put options

- The implied volatility levels for CDX.IG looked elevated compared to CDX.HY both on outright basis and vs realized volatilities
- Moreover, in a 3m, 6m or 1y perspective, HY looked at least 40bp too tight vs IG
- HY was also likely to underperform in a selloff as spreads decompress
- We believed a market selloff would lead to HY underperformance
- Therefore, doing the trade through options would allow us to express the views on the indices and take advantage of the difference in implied volatilities
- Trade recommendation on July 19, 2012: Sell \$900mn CDX.IG 120bp December 2012 puts at 220c and buy \$200mn CDX.HY \$95 December 2012 puts at 49c; Total upfront received: \$90K
- Trade worked: could exit on October 24, 2012 with a \$225K gain (15% ROI / 69% IRR)

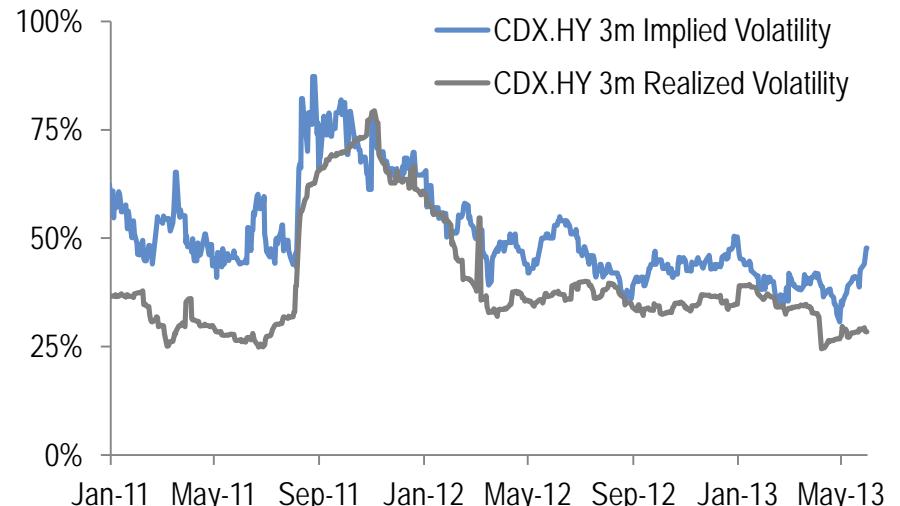


History of Implied and Realized Volatility

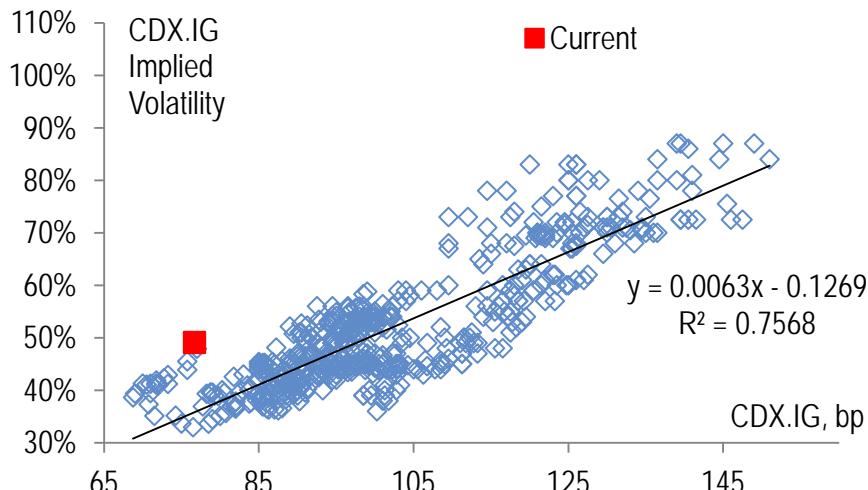
CDX.IG



CDX.HY

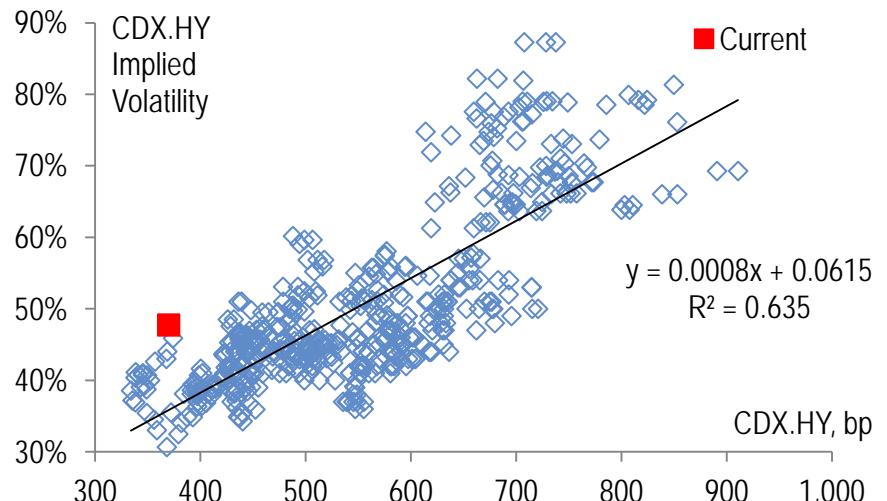


CDX.IG Implied Volatility vs Index



Source: J.P. Morgan

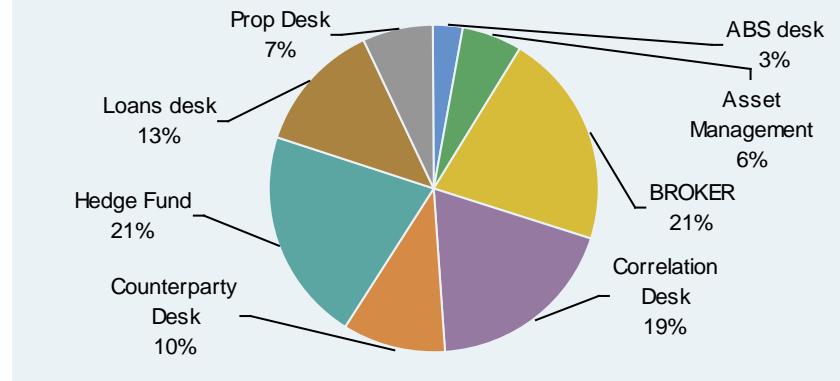
CDX.HY Implied Volatility vs Index



CDX Options: Market Structure

- >\$1tn annual option volume globally
- 75% client trades
- CDX.IG bid/offer: 2-4c
- HY bid/offer: 10-20c
- Typical size: \$250m to \$500m
- Volumes based on DTCC/SDR data
 - CDX.IG: \$3bn/day on average
 - CDX.HY: \$750mn/day on average

Trades by Counterparty



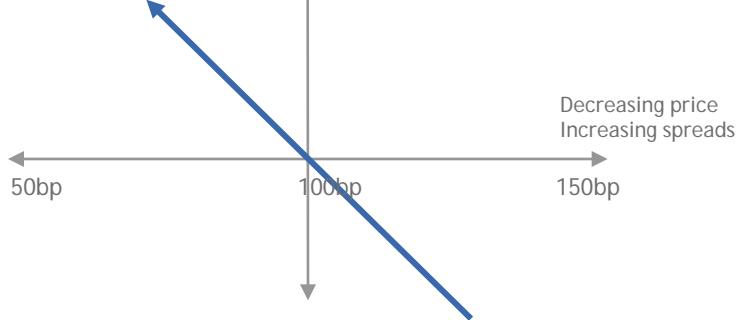
Source: J.P. Morgan

Account Type	Use of Options	Type of trade	Standard Size
Correlation desks	Need to hedge gamma exposure	Buy naked options or trade structure (payer spreads, ladders, cylinders)	500m->2bil
ABS counterparties	Hedging portfolios and options found to be a better instrument to hedge their underlying than the index	Buyer of naked options	250m
Loan desk	Portfolio protection for large moves wider	Buyer of naked options	500m
Counterparty desks	Portfolio protection for large moves wider	Buyer of naked options, sometimes buy payers and sell receivers	250m
HF / Prop	Trading opportunities	Gamma trades; cross-market trades, portfolio hedges	100m-300m

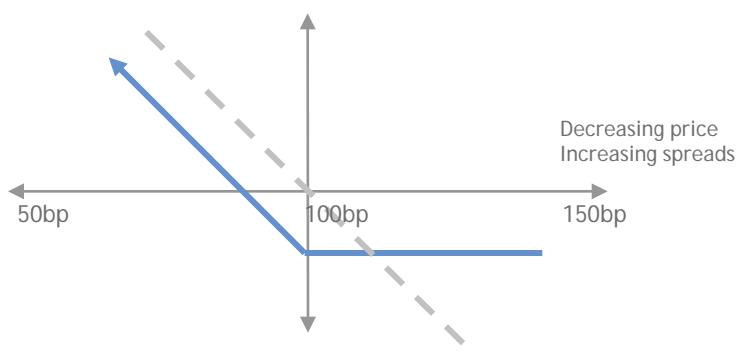
Source: J.P. Morgan

Expressing a Bullish View on Spreads

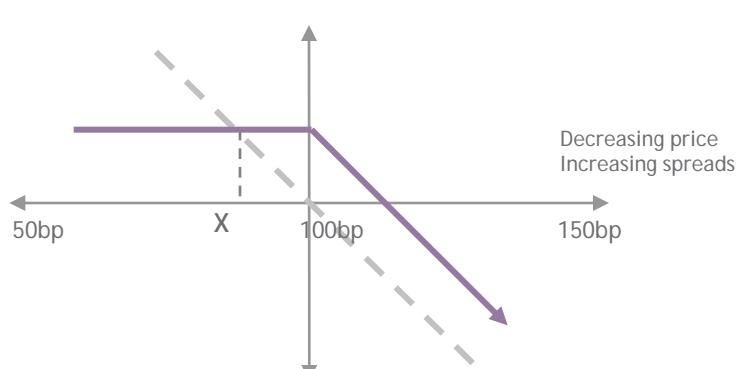
Sell index protection



Buy Call



Sell Put



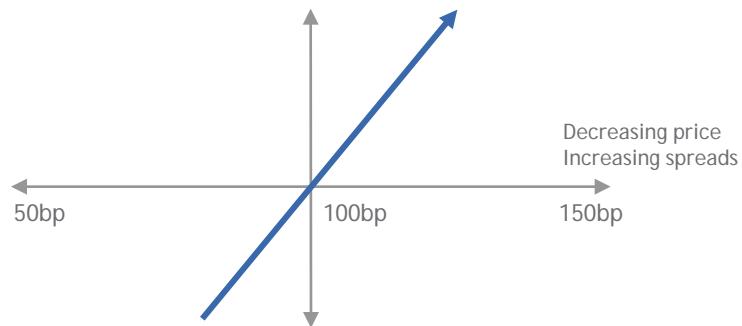
- Simplest strategy to take a view on spread tightening
- Linear return profile if spreads widen or tighten
- Unlimited downside risk if spreads widen

- Limit downside risk by buying a call option
- Full upside in spread tightening (minus premium)

- Bullish view if believe spreads will tighten but not past “x”
- Strategy outperforms selling index protection for levels above “x”

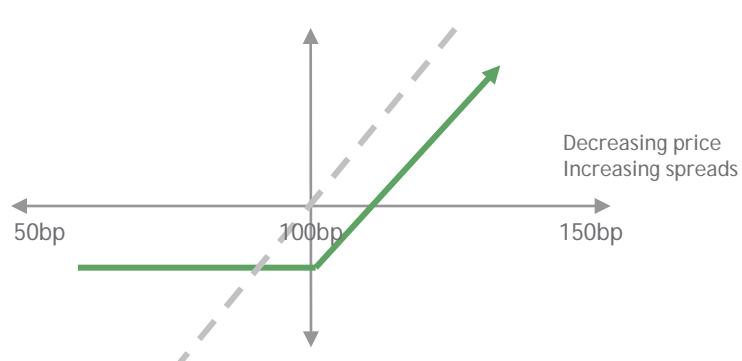
Expressing a Bearish View on Spreads

Buy index protection



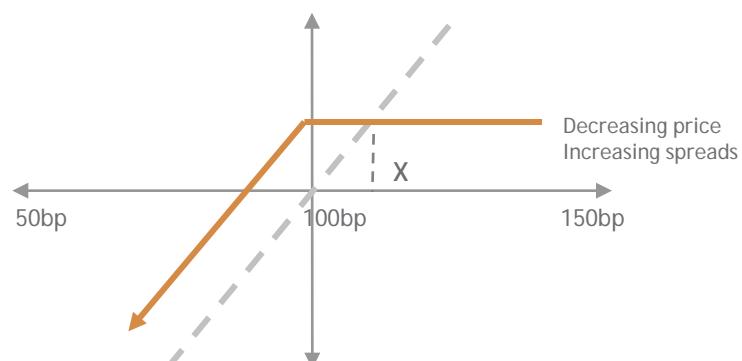
- Simplest strategy to take a view on spread widening
- Linear return profile if spreads widen or tighten
- Downside risk capped as spreads cannot be negative

Buy Put



- Limit downside risk by buying a put option
- Full upside in spread widening (minus premium)
- Maximum loss limited to premium paid for option

Sell Call



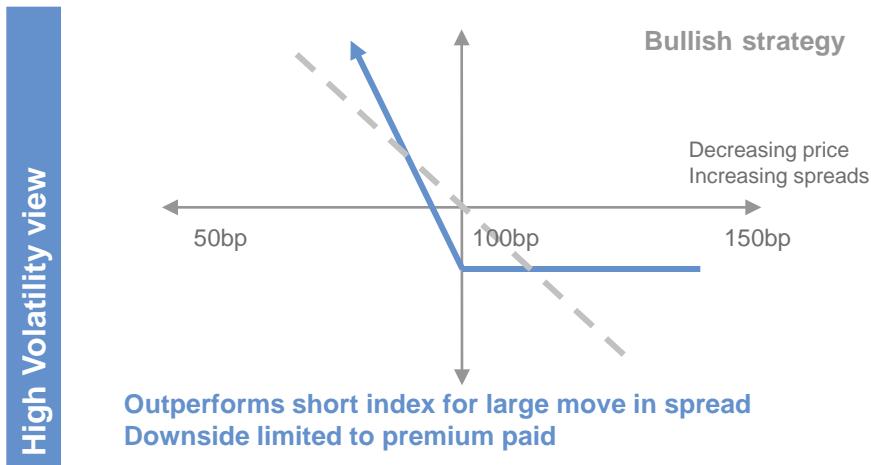
- Bullish view if believe spreads will widen but not past “x”
- Strategy outperforms buying index protection for levels below “x”

Incorporating Volatility with a Bullish View on Spreads

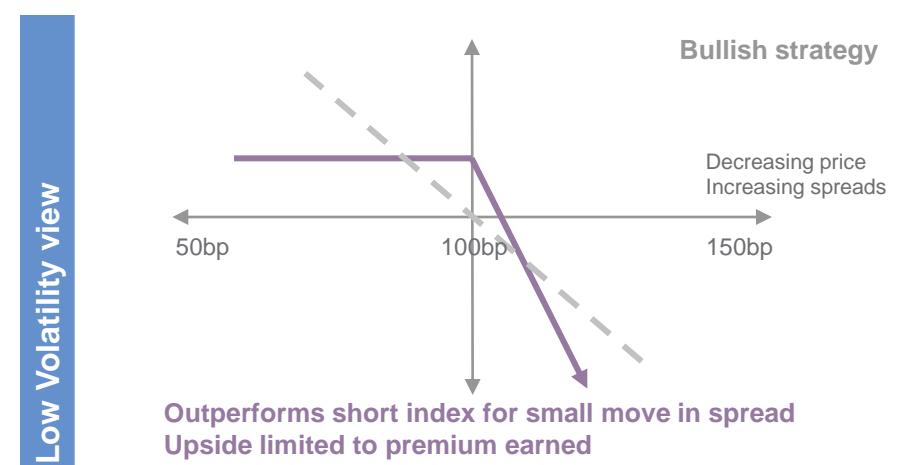
Introducing Delta

- The Delta of an option measures how much the value of an option should change if the underlying asset moves by 1 unit
- At-the-money options have a delta of 0.5
- To get the same MtM as an outright CDX index position (i.e. delta of 1), option notional has to be twice that of index position

Buy 2x Call Option



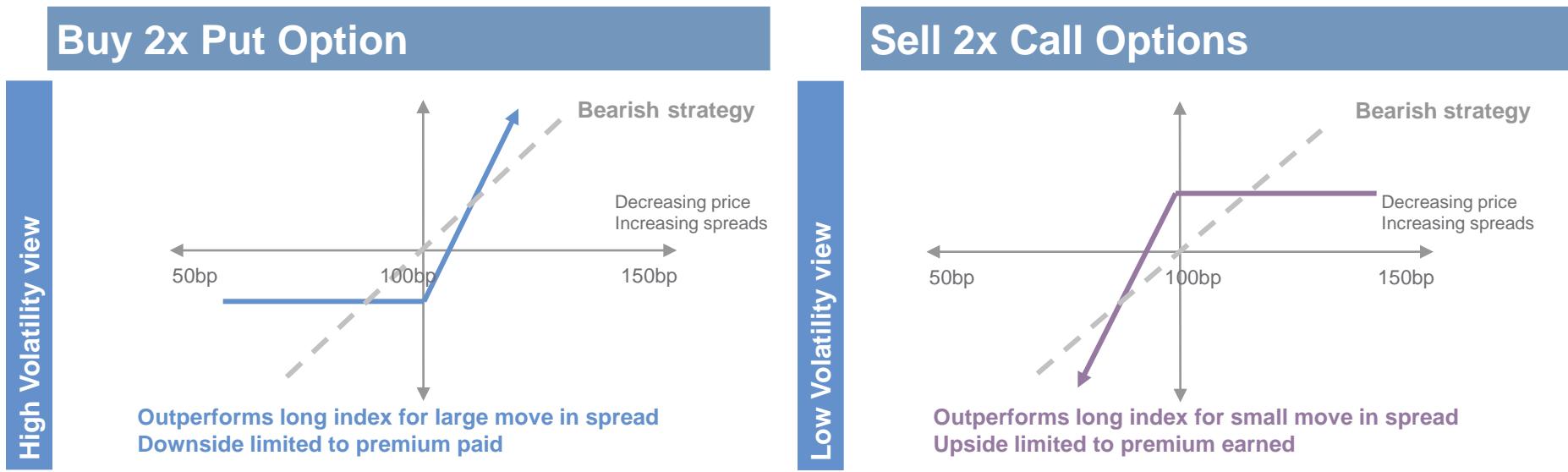
Sell 2x Put Options



- View: bullish spread with high volatility, buy 2x call options
- Relative performance vs 1x index
 - Outperforms index for large tightening
 - Downside if spreads widen is limited to premium paid

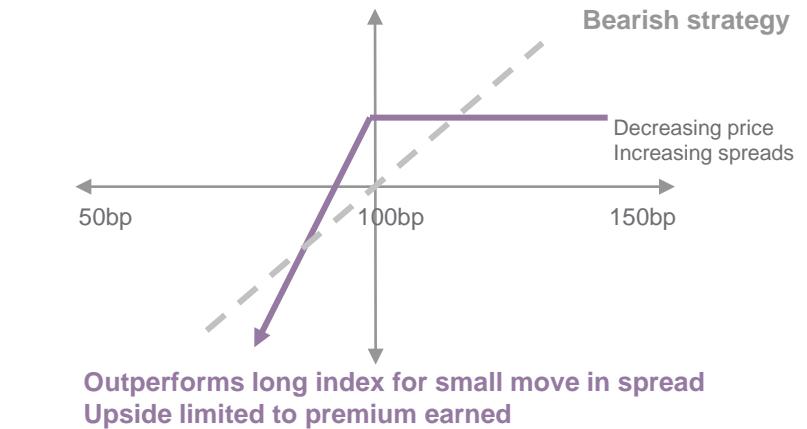
- If bullish spread with low volatility, sell 2x put options
- Relative performance vs 1x index
 - Outperforms selling index if spreads move within range

Incorporating volatility with a bearish view on spreads



- As with bullish strategies, position is doubled to match delta of a short CDX risk position (equal to 1)
- If bearish view on spreads combined with a high volatility view, buy 2x put options
- Relative performance vs 1x index
 - Outperforms buying index protection for large move in spread
 - Downside if spreads tighten limited to premium paid

Sell 2x Call Options



- With a bearish view on spreads combined with a low volatility view, sell 2x call options
- Relative performance vs 1x index
 - Outperforms buying index protection if spreads move within range

Online Credit Index Options Analyzer

Option trade inputs: maturity, strike and volatility

Option trade outputs: premium, breakevens and option greeks

J.P. Morgan Markets - CDS Index Options Trade Analyser - Windows Internet Explorer provided by JPMorgan Chase & Co.

https://markets.jpmorgan.com/#analytics.credit.cds_index_options

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Contact Us Help Search Research and Analytics

Credit > CDS Index Options Trade Analyser

Empire Curve Trade Analyser Options Trade Analyser

Trade Set-Up

Master Settings

Trade Date: 02-06-2013

Calculation Mode: Input price, output vol

Index Settings

Index: CDX NA IG

Series: s20

Option Settings

Position Type: Buy

Option Type: Payer

Notional (\$): 100,000,000

Strike Spread (bp): 95

Expiry: 10-09-2013

Click here for more options

Graph Range: Auto-generated

Graph Dates: Auto-generated

Trade Analysis

Analytics

	Option 1	Index	Aggregate
Index Upfront	-1.02%		
Index position (\$)	No Position		
Option Price (cents)	42.0	42.0	42.0
Cash Amount (\$)	420,000	420,000	420,000
Option Volatility	71.1%		
Breakevens (bp)	104.1		
Option Delta	45.0%	45.0%	45.0%
Delta Notional (\$)	22,024	22,024	22,024
Option Gamma	1.3%	1.3%	1.3%
Theta (cents)	0.03	0.03	0.03
Theta Notional (\$)	283	283	283
Option Vega (cents)	0.84	0.84	0.84
Vega Notional (\$)	8,421	8,421	8,421
Rho (cents)	-0.02	-0.02	-0.02
Rho Notional (\$)	-195	-195	-195

Scenario Analysis

Graph Data

P/L (\$)

Index Spread (bp)

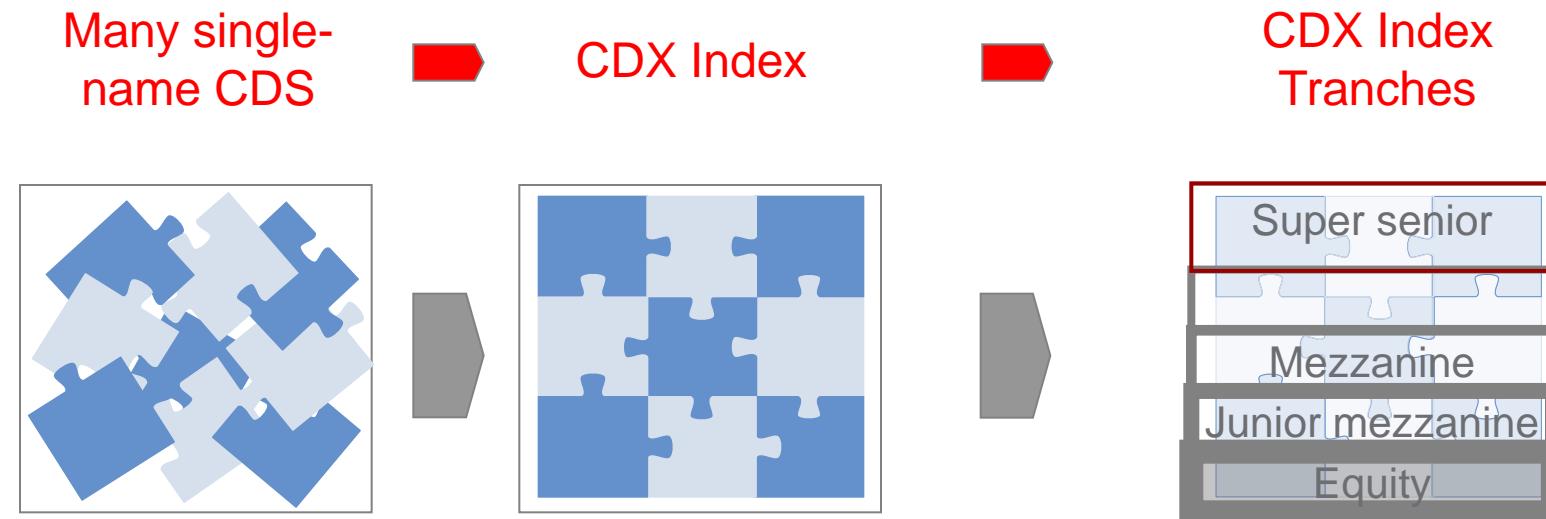
Legend: 02-Jun-13, 08-Jul-13, 13-Aug-13, 18-Sep-13

Feedback Status: Green

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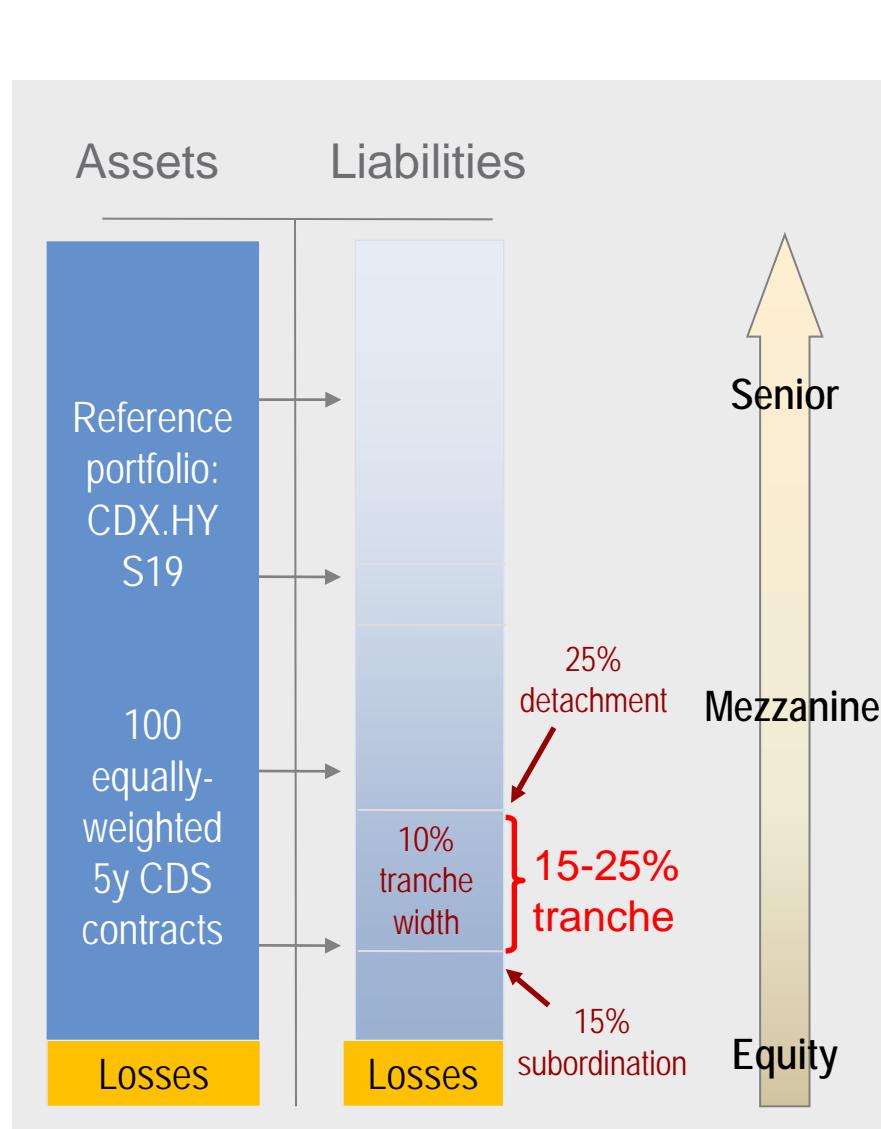
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CDX Index Tranches: Combining a view on specific credit risk and macro credit risk



- Building blocks of underlying portfolio: many individual single-name CDS
- There are 100 single-name CDS initially used for the composition of the CDX.HY portfolio when a new index is launched
- CDX index refers to a portfolio containing all these single-name CDS
- Risk is taken on all these names in one CDX index trade
- Tranches: analogy with a company capital structure
 - Equity tranches exposed to the first losses, like equity investors in a company
 - Senior tranche more protected from losses, as a company's senior debt would be

Portfolio Losses Impact Junior Tranches First



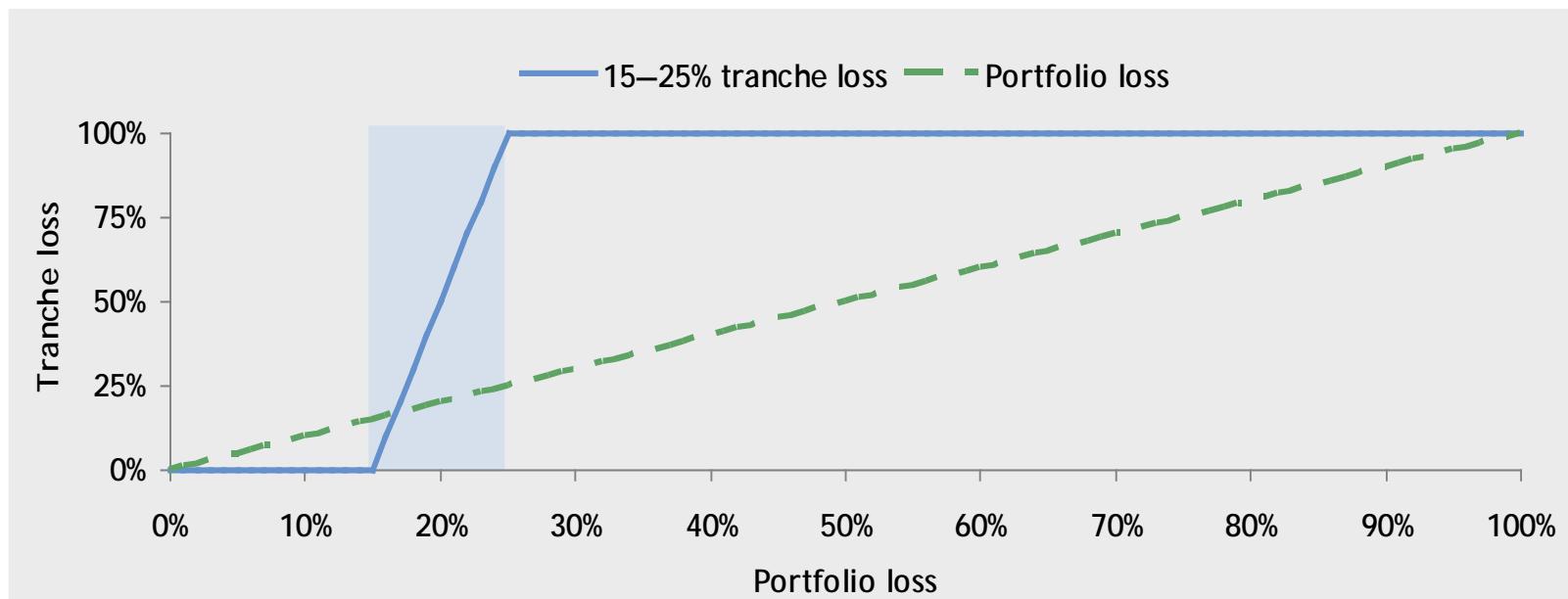
Impact of defaults and losses

- As the portfolio experiences losses
 - Equity tranches are most junior and take the first notional losses
 - Mezzanine and senior holders do not take notional losses until the more junior tranches are gone
 - Equity tranches are therefore highest return and highest risk
 - Senior tranches are lower return and lower risk
- “15-25% tranche”
 - Subordination: 15%
 - Loss the index can suffer before the tranche notional starts to erode
 - Also known as attachment point
 - Detachment point: 25%
 - Tranche width: 10%
 - Distance between lower and upper attachment points

Source: J.P. Morgan

Basic mechanics of a tranche protection contract

- Mezzanine tranches are subordinated, and begin to suffer notional losses once the portfolio loss exceeds the lower attachment point
- But tranches have a different risk profile to the underlying portfolio
 - For example, lower tranches typically have a leveraged exposure
- Example: 15-25% tranche loses value relative to the portfolio
 - The tranche level will move depending on
 - Overall risk in the portfolio
 - Credit risk of specific companies
 - A tranche trade allows investors to take a view on both risks



Index Tranches

Trading protection on an index tranche

- The standardised tranche market allows liquid trading on tranches
- Two-way prices for buying and selling protection are quoted by traders
 - Dealers bid/offer for protection, i.e., they will buy protection at the bid level
- Like CDS, tranche protection traded as running spread or upfront payment
 - CDX.HY tranches quoted in price terms+ 500bp running spread, just like the index
 - Tranches also trade in vintage indices which already have experienced defaults

Standardized tranches on CDS indices:

Indices since S15 for IG,
S13 for HY and S12 for LCDX

Indices up to S13 for IG, S12
for HY and S11 for LCDX

iTraxx	CDX.IG	CDX.HY	LCDX
0-3%	0-3%	0-15%	0-8%
3-6%	3-7%	15-25%	8-15%
6-9%	7-15%	25-35%	15-30%
9-12%	15-100%	35-100%	30-100%
12-22%			
22-100%			

iTraxx	CDX.IG	CDX.HY	LCDX
0-3%	0-3%	0-10%	0-5%
3-6%	3-7%	10-15%	5-8%
6-9%	7-10%	15-25%	8-12%
9-12%	10-15%	25-35%	12-15%
12-22%	15-30%	35-100%	15-100%
22-100%	30-100%		

Source: J.P. Morgan

Sample runs and volumes for CDX.IG and CDX.HY tranches

<HELP> for explanation.
 <Menu> to Return.

1) Delete 2) Reply 22) Reply All 3) Forward 12) Prev 11) Next 99) Options ▾ Message: View

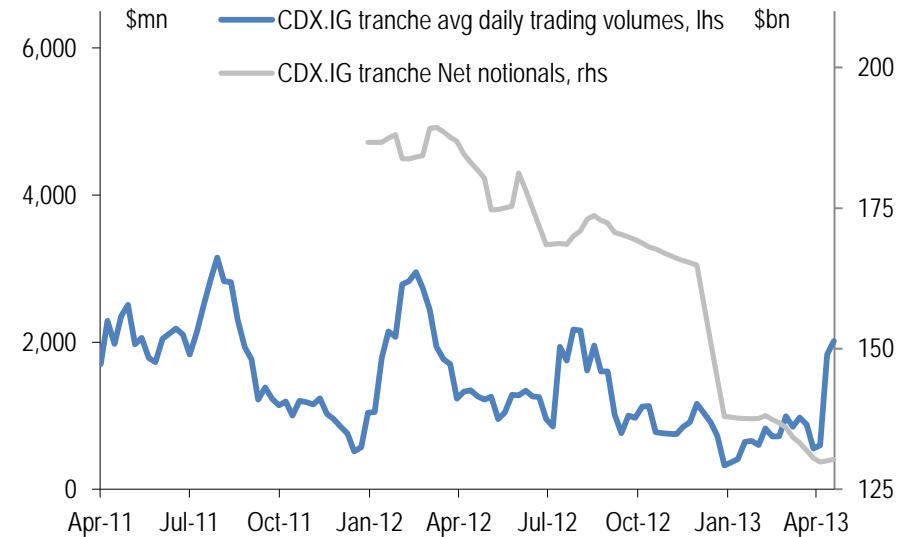
✓ Jun 7 2013 15:55:08
 From JOSEPH ARCADI (JP MORGAN SECURITIES)
 Subject JPM IG9 TRANCHE CLOSING LEVELS
 Attached No Attachments

JPM INDEX TRANCES {GPGX 78 58 5<GO>} (w) 212-834-3652

	7Y(34)	Chg	Lev	10Y(87)	Chg	Lev	Cpn
0-3	8 ¹ / ₄ / 9 ³ / ₈	- ¹ / ₄	20.6	42 / 42 ¹ / ₂	- ¹ / ₂	7.30	5%
3-7	-6 / -5 ¹ / ₂	+ ¹ / ₈	5.30	2 ¹ / ₂ / 3	- ¹ / ₄	6.90	5%
7-10	-7.25/-7.1	-	1.80	-10.4/-10.0	-	4.10	5%
10-15	-1.45/-1.35	-	0.50	.3 / .55	-	2.00	1%
15-30	-1.54/-1.49	-	0.20	-2.43/-2.28 +.07	0.90	1%	
30-100	-1.52/-1.49	-	0.12	-3.68/-3.61 +.02	0.28	1%	

Spread 7Y 10Y
 0-3 1131 | 1782
 3-7 128 | 565
 7-10 38 | 268
 10-15 10 | 109
 15-30 3 | 48
 30-100 3 | 19

Tranches updated on JPTE {GPGX 78 58 5<GO>}



<HELP> for explanation.
 This Message is Non-forwardable, <Menu> to Return.

1) Delete 2) Reply 22) Reply All 3) Forward 12) Prev 11) Next 99) Options ▾ Message:

✓ Jun 7 2013 16:00:50
 From WILL HABER (JP MORGAN SECURITIES) 1-212-834-2510 (m) 512-785-4453
 Subject JPM HY TRANCHE CLOSING LEVELS
 Attached No Attachments

JPM CREDIT TRADING - INDEX TRANCES/IBOXX (w) 212-834-2510 (m) 512-785-4453

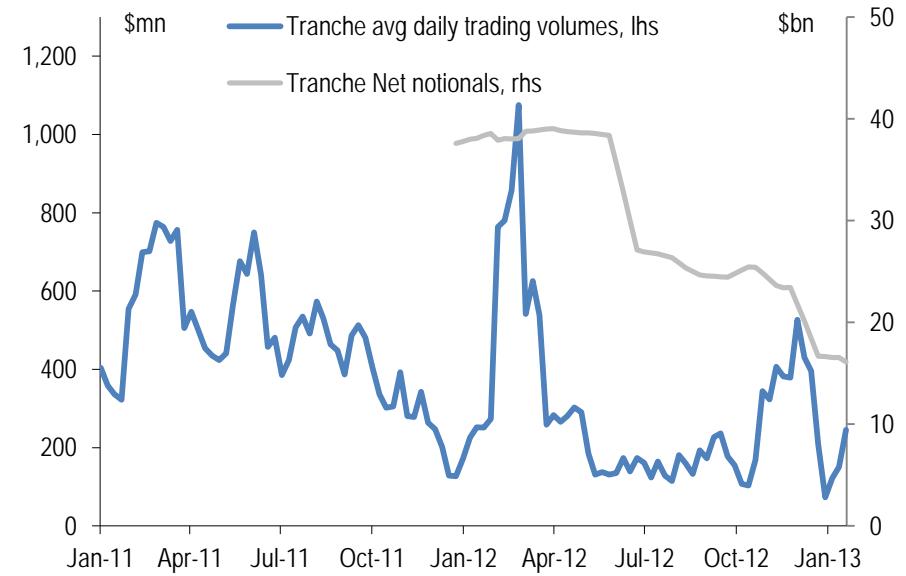
** HY quotes in risk terms, bond px UF+Cpn

	3Y(107)	Chg	Lev	5Y(105.5)	Chg	Lev	Cpn
0-15	81 ¹ / ₄ / 82 ¹ / ₄	- ¹ / ₄	4.50	55 ¹ / ₈ / 56 ³ / ₈	+ ¹ / ₈	2.50	5%
15-25	108 ¹ / ₂ / 109 ¹ / ₂	-	1.30	100 ¹ / ₈ / 101 ¹ / ₈	+ ¹ / ₈	1.90	5%
25-35	110 ⁵ / ₈ / 111 ⁵ / ₈	-	0.60	110 ¹ / ₄ / 111 ¹ / ₄	+ ¹ / ₈	1.20	5%
35-100	111 ⁵ / ₈ / 112 ⁵ / ₈	-	0.25	116 ⁵ / ₈ / 117 ¹ / ₄	- ¹ / ₈	0.50	5%
Index	Cpn: 500 Factor: 1						

HY17 3Y(105.25) Chg Lev | 5Y(106.5) Chg Lev | Cpn

	3Y(105.25)	Chg	Lev	5Y(106.5)	Chg	Lev	Cpn
0-15	89 ³ / ₄ / 90 ³ / ₄	-	5.30	61 ⁵ / ₈ / 62 ⁵ / ₈	-	2.90	5%
15-25	105 ³ / ₄ / 106 ³ / ₄	-	1.30	103 / 104	+ ¹ / ₈	2.00	5%
25-35	107 ³ / ₈ / 107 ³ / ₈	-	0.30	110 ⁵ / ₈ / 111 ⁵ / ₈	+ ¹ / ₈	1.10	5%
35-100	107 ¹ / ₂ / 107 ¹ / ₂	-	0.10	114 ⁵ / ₈ / 115 ¹ / ₈	-	0.45	5%
Index	Cpn: 500 Factor: 0.96						

Tranches updated on JPTE {GPGX 78 58 <GO>}



Source: Bloomberg

Source: DTCC

CDX Indices, TRS, Options, and Tranches - Summary

- CDX indices are the most liquid credit products.
- TRS are newer, but structurally interesting for macro credit trades.
- Allow trading a general market view or to hedge
- Indices are attractive for relative value trades
- Index options allow taking a view on both direction and volatility
- Index tranches allow taking a view on distribution of losses in an index, driven by single-name risk and/or by overall macro credit risk

Credit Markets Outlook and Strategy

J.P.Morgan

North America Credit Research
07 June 2013

Credit Market Outlook & Strategy

US High Grade Strategy & CDS Research

High Grade Strategy

We continue to expect HG bonds spreads to tighten over time and maintain our OW recommendation. Higher UST yields make bonds more attractive and we believe investors are waiting for lower volatility to add risk, not to reduce it. Supply should slow, due to less from EM, higher spreads and the usual summer pattern. Pension funds also benefit from higher bond yields reducing the value of liabilities, while higher stocks raise asset values, so demand for the long end bonds should increase from them. Fundamentally, higher UST yields are positive for bank margins and lower commodity prices are positive for many sectors.

Credit Derivatives

CFTC has published its final rulings for CDX SEF trading which will start on October 2nd for the first phase. The recent CDX indices selloff has been orderly in credit. However, credit has significantly underperformed equities. Evidence suggests that bond investors are hedging with CDX. CDX implied volatility now looks too high relative to the indices or to equity volatility. The front end of CDS/CDX curves has steepened. We expect curves to remain relatively directional going forward. Finally, tranche correlation has fallen over the last week and we believe this will continue.

US High Grade Strategy & CDS Research

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Report Repertoire – emails are distributed daily

CDS Single-Name Analytics

- High Grade CDS-Bond Basis Report
- High Yield CDS-Bond Basis Report
- High Grade CDS Curve Report

Tranche / Correlation Products

- Global Correlation Daily
- Tranche Snapshot Report

Cash Index Reports

- JULI Snapshot
- iBoxx TRS Daily Analytics

CDX and LCDX Analytics

- Global Credit Derivative Index Report
- CDX.IG Daily Analytics
- CDX.HY Daily Analytics
- LCDX Daily Analytics
- CDX Options Daily Analytics

Summary Package

- CDS Notional Outstanding Report
- Daily Snapshot
- J.P. Morgan CEV Debt / Equity Report

Research is available on the Credit Derivatives webpage, www.jpmorganmarkets.com

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Credit - Derivatives

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51 minutes ago Tina T Zhang, Saul Doctor	Daniel Lamy, Tina T Zhang, Stephen Dulake	May 22, 2013 Tina T Zhang, Saul Doctor	May 8, 2013 Tina T Zhang, Saul Doctor	April 23, 2013 Tina T Zhang, Saul Doctor	Eric Beinstein eric.beinstein@jpmorgan.com (1-212) 834-4211
Back in Opposite World: European Credit Outlook & Strategy April 2013	Credit Market Technical Indicators: Strategies for Rules-based and Algorithmic Investors 3 April 2013	Credit Market Technical Indicators: Strategies for Rules-based and Algorithmic Investors 20 March 2013	Credit Market Technical Indicators: Strategies for Rules-based and Algorithmic Investors 7 March 2013	No Alarms, Lots of Surprises: European Credit Outlook & Strategy March 2013	Dominique Toublan dominique.d.toublan@jpmorgan.com (1-212) 834-2370
April 11, 2013 Stephen Dulake, Daniel Lamy, Tina T Zhang	April 3, 2013 Tina T Zhang, Saul Doctor	March 20, 2013 Tina T Zhang, Saul Doctor	March 7, 2013 Tina T Zhang, Saul Doctor	March 7, 2013 Daniel Lamy, Tina T Zhang, Stephen Dulake	Miroslav Skovajsa miroslav.j.skovajsa@jpmorgan.com (1-212) 834-5154
Quote Sheet and Analytics ▶ All Regions	CDX.NA.IG Daily Analytics 1 hour ago Eric Beinstein, Dominique D. Toublan	CDX.NA.HY Daily Analytics 1 hour ago Eric Beinstein, Dominique D. Toublan	US Corporate High Grade Basis Report 2 hours ago Eric Beinstein, Dominique D. Toublan	US Corporate High Yield Basis Report 2 hours ago Eric Beinstein, Dominique D. Toublan	Saul Doctor saul.doctor@jpmorgan.com (44-20) 7134-1539
Miroslav J Skovajsa	Miroslav J Skovajsa	Miroslav J Skovajsa	Miroslav J Skovajsa	Muni CDX (MCDX) Daily Analytics 2 hours ago Eric Beinstein, Dominique D. Toublan	Danny White danny.c.white@jpmorgan.com (44-20) 7134-1812
				Miroslav J Skovajsa	Aida Mehonie aida.mehonie@jpmorgan.com (44-20) 7134-2416

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