Introduction to Credit Derivatives

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Beirut, February 2013
Credit Derivatives

1. Credit concepts
2. CDS mechanics and uses
3. CDS basis
4. CDS indices
5. First-To-Default baskets
6. Structured Credit
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6. Structured Credit
A credit spread represents the extra compensation required to cover the risk of default.

- ABC corp may borrow at Libor + 200bps for 5Y. The 200bps represent a credit spread.
- ABC issues (at par) bond with 6% coupons for 5Y when 5Y swaps trade at 4%. The 2% is a credit spread, the asset swap spread of the bond.
- In a 5Y CDS on ABC corp, the protection seller receives 200bps p.a. as long as there is no ABC default.

The 3 above numbers should be the same as they all represent the 5Y credit spread for ABC.
Key Drivers of Credit Risk

Credit Risk

Borrower Characteristics
- Who is the Bank lending to? How correlated to other exposures?
  - Probability of Default (PD)

Facility Characteristics
- How much exposure does the Bank expect to have should the borrower default?
  - Exposure at Default (EAD)
- Time to repayment?
  - Maturity (M)
- What is the % the Bank expects to lose, given seniority, collateral and other loss mitigation?
  - Loss Given Default (LGD)
Quantifying Credit Risk

Expected Loss = CPD × EaD × LGD

Where

CPD = Cumulative Probability of default
   ~ Market vs. historical measure

EaD = Exposure at default
   ~ predicted based on typical credit line usage or derivative exposure

LGD = Loss given default = 1 – Recovery
   ~ predicted based on recovery rates experienced
Exercise

Example:

Transaction 1:

US$ 100 million 5 year ATM IRS Receiving fixed at 5%

Expected exposure after one year: US$ 2 million
Probability of default (PD) [one year horizon]: 0.12% (A)
Loss Given Default (LGD): 50%

Transaction 2

US$ 2 million corporate loan
- bullet repayment
- fully drawn facility

Probability of default (PD) [one year horizon]: 2.3% (BB)
Loss Given Default (LGD): 70%

What is the expected loss for both facilities?
Understanding the credit spread

Intuitively, the credit spread should be equal to the difference between the contractual interest rate and the risk-free interest rate

Credit Spread = Expected Loss (EL) / Maturity

EL = cumulative probability of default * Loss Given Default

LGD = 1 – R (Recovery Rate)

If ABC corp has 20% cum proba of default in the next 5 years, Recovery=40% (LGD=60%)

EL=20%*(1-40%)=12%

Credit spread = 12% / 5 = 2.4%
R=50%

1) ABC has a proba of default over 1Y of 2% - credit spread on 1Y bond?
2) DEF has a 5Y credit spread of 350bps – cumulative proba of default?
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CDS – Brief History

- CDS instruments were first conceived of back in the early 90’s, the modern version commonly accredited to J.P. Morgan when they distributed the risk they took on with an Exxon credit line after the Exxon Valdez oil spill disaster.
- The ISDA standardised the CDS documentation in 1999 and CDSs became exempt from regulation by the SEC in 2000.
- Initially banks were dominant players using the instruments as hedges.
- By 2002, speculative traders were the new dominant participants at which point the market reached a level at around $2 trillion.
- By the end of 2007 this level was at over $60tr but dropped 40% during the economic downturn (partly due to netting of contracts)
Credit Default Swap structure:

- **Protection Seller**: (“Long” in the underlying security issuer)
- **Protection Buyer**: (“Short” in the underlying security issuer)
- **Fee/Spread (xx bppa)**
- **Default Payment**
- The Protection Buyer pays a Quarterly Fee ("the spread") to the Protection Seller. Until 2009 CDS were traded at par however now standard fixed coupons are used globally.

- These are Europe – 25bp, 100bp, 500bp and 1000bp
  America – 100bp and 500bp

- These trades now have an NPV at inception and this requires an upfront payment to or from the seller. This depends on the credit worthiness of the reference entity.

- E.g. Instead of “Buying Par Protection @350bp” we now either “Buy Protection @100bp and pay 11.25% upfront” or “Buy protection @500bp and receive 6.75% upfront”.

(These Cash Flows are Shown in the Diagrams on the next slide)
Example of Cash Flows for Protection Seller

- **No Credit Event** –

- **Credit Event in Year 3** –
Example of a range of standard coupon with upfront cash payment.

- **Sell par protection @ 350bp**

- **Sell protection @ 100bp and receive 11.25% upfront**

- **Sell protection @ 500bp and pay 6.75% upfront**
SNAC (Standard North American Contract)

<HELP> for explanation, <MENU> for similar functions.

Credit Default Swap

Deal
- Buy: Notional 10 MM USD
- REF Entity: Colgate-Palmolive Co
- Debt Type: Senior
- REF Obligation: US19416QBX79
- Trade Date: 06/21/12
- 1st Accr Start: 06/20/12
- 1st Coupon: 09/20/12
- Pen Coupon: 06/20/17
- Maturity: 5Y 09/20/17
- Use Curve: Recovery Rate True
- Recovery Rate: 0.40

Market
- Curve Date: 06/21/12
- Swap Curve: 260 Mid
- CDS Curve: C CBGN Ask
- Recovery Rate: 0.40
- Term: 09/20/17 - 2.676365
- Spread: 47.5449
- Prob: 0.0413

View Historical Data 2 Year

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

Quoted spread 47.54 bps but coupon of 100bp +/- upfront

Coupon of 100bps ± upfront

Upfront = Principal + Accrued

Principal = -$267,636
(probability of survival weighted PV of the difference between the CDS fee and the CDS coupon accrued)

Accrued = -$556
(2 days)

Upfront = -$268,192

This amount is to be paid by the seller of protection to the buyer on T+3
- These Payments are made quarterly and are calculated on an Actual/360 basis.

- The Protection Seller undertakes to indemnify or compensate the Protection Buyer in the event of a “Credit Event”.

- CDS contracts have maturities usually ranging from 1yr to 10yrs. The maturity always falls on one of four roll dates; 20 March, 20 June, 20 September or 20 December.

- The contract specifies the deliverable obligations (method of settlement), the triggers for a “credit event” and the allowance of certain types of debt restructuring so as not to trigger an event.
- Collateral is posted against counterparty risk and profit/loss is recorded when there is a margin call if the spread moves far enough away from the initial level.

- The notional is usually $10m -$20m for an individual contract.

- The protection buyer does not need to own any of the debt upon which the CDS is referenced. This is called a “Naked Credit Default Swap”, effectively betting against the credit-worthiness of a company or country.

- If the reference debt is also owned by the investor then it is seen as a hedging strategy and they are often called “synthetic hedges”.

The credit crisis of 2007-2009 led to major changes in the CDS market aimed at standardising CDS so as to

• reduce counterparty and systemic risk
• enhance offset-ability and therefore liquidity
Areas of change

1- Big Bang / Small Bang
   • Introduction of the Big Bang (North America) and Small Bang (Europe) protocols aimed at standardising contracts and ease clearing and reduction of notional outstanding contracts
   • *Hard wiring* of the auction process upon credit event
   • *Use of IMM dates*
   • Treatment of *Restructuring*: North America = no restructuring; Europe = Mod Mod R (MMR)

2- Quoting convention
   • standard coupons: upfront plus fixed coupon and first full coupon; some other changes in CDX and iTraxx (more later)
   • standard model allowing easy conversion between upfront and spread – ISDA Upfront Model (Bloomberg on page CDSW)
Areas of change

3- Clearing

• introduction of central clearing to reduce counterparty and systemic risks
• main clearing centres:
  – DTCC through its subsidiary the Warehouse Trust
  – the InterContinental Exchange (ICE)
• estimated that 90% of all contracts can be netted off
• according to DTCC from Oct08 to Jun10 gross outstanding contracts dropped from $33.6trn to $24.8trn in spite of 4-wk rolling traded volume rising from $5.4trn in Mar09 to $7.7trn in Jun10
Credit Events

The following three Credit Events are the most commonly used in Europe and North America.

• **Failure to Pay**
  The most universally fundamental idea of default – failure to make payments to creditors. Threshold of $1m.

• **Bankruptcy (for non-sovereign borrowers)**
  A loosely defined concept of bankruptcy / insolvency and international equivalents.

• **Restructuring of debt**
  This event is intended to capture the circumstance where a borrower negotiates reduced terms on its debt, such as one of the following:

  1. a reduction in the rate or amount of interest payable
  2. a reduction in the amount of principal
  3. a postponement of payment (interest or principal)
  4. a change in ranking of priority (subordination)
  5. a change in the currency of composition of any payment
Upon presumption of credit event, market participant requests a Credit Event Resolution (aka the “Credit Event Resolution Date”) from a Determinations Committee

Determinations Committees (DCs)

- 5 regional committees: Americas, Asia (ex Japan), Japan, Australia-NZ, EMEA
- 15 voting members (8 global dealers, 2 regional dealers, 5 non-dealers) voting with a super-majority of 80%
- ISDA provides administrative support
- makes resolutions on
  - whether a credit event has occurred and on what date (within 2 days of a submission)
  - Instruct the auction to settle the contract (usually should take place 30 days after credit event)
  - which obligations are deliverable in the contract
  - questions about succession issues
  - any “matter of contractual interpretation relevant to the credit derivatives market generally”
Case Study: Greece
Greece Credit Event

Final Results of the Hellenic Republic CDS Auction, 19 March 2012

Final Price: 21.5

On 19 March 2012, 14 dealers submitted initial markets, physical settlement requests and limit orders to the Hellenic Republic auction administered by Creditex and Markit to settle trades across the market referencing Hellenic Republic.

Relevant Currency

EUR

Auction Currency Rates

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<tr>
<th>Currency</th>
<th>Rate</th>
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</thead>
<tbody>
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<td>EUR/GBP</td>
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<td>EUR/JPY</td>
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<tr>
<td>EUR/USD</td>
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The inputs and results are detailed below.

Initial Markets

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<tr>
<th>Dealer</th>
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<th>Offer</th>
<th>Dealer</th>
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<td>23.625</td>
<td>Bank of America N.A.</td>
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<td>22.5</td>
<td>Citigroup Global Markets Limited</td>
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<td>23.125</td>
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<tr>
<td>UBS AG</td>
<td>20.5</td>
<td>22.5</td>
<td>UBS AG</td>
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</table>

Initial Market Midpoint: 21.75
Settlement Methods

Cash - Reference Price (Often ‘Par’) minus Post-Default market price or “Recovery Rate”, (often noted as “1-Recovery”).

• This method, using the above analogy, is similar to an insurance company paying out the difference between the insured value and the residual value on the basis that this represents the actual economic loss. Thus the compensation is (1-Recovery).

• The residual value of the debt is often addressed at an auction process.

• Chief Advantage: Not dependent upon the availability of deliverable bond or loan products.

• Chief Disadvantage: Defaulted or Distressed bonds are typically highly illiquid and it can, in consequence, be very hard to obtain both accurate ‘post default market prices’ or any value at all.
Auctions ("Credit Fixing Event")

• Facilitates settlement of a large number of contracts after Credit Event.

• Bids are submitted by participating dealers at levels at which they would consider the value of the debt obligations to be.

• All cash and physical settlements are cleared at a final price set in the final phase of the auction.

• These auctions are organised by the ISDA (the International Swaps and Derivatives Association).
## Recent Auction results

<table>
<thead>
<tr>
<th>Ticker, Name, Type, Tier, Auction Date, Final Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>GM-ResCLLC, &quot;Residential Capital, LLC&quot;, CDS, SENIOR, 6-Jun-12, 17.625</td>
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<td>HTNMIF, Houghton Mifflin Harcourt Publishing Company, CDS, SENIOR, 30-May-12, 55.5</td>
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<td>HAWKER-Acqui, &quot;Hawker Beechcraft Acquisition Company, LLC&quot;, LCDS, LIEN 1, 26-Apr-12, 63.5</td>
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<td>ERCIFT, ERC Ireland Finance Limited, CDS, SENIOR, 29-Mar-12, 0</td>
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<td>FCGIA, Financiere Gaillon 7, ELCDS, LIEN 1, 28-Mar-12, 98</td>
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<td>HITACH-Elpida, &quot;Elpida Memory, Inc.&quot;, CDS, SENIOR, 22-Mar-12, 21</td>
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<td>GREECE, Hellenic Republic, CDS, SENIOR, 19-Mar-12, 21.5</td>
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<td>EK, Eastman Kodak Company, CDS, SENIOR, 22-Feb-12, 23.875</td>
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<td>NRAMC, Northern Rock (Asset Management) plc, CDS, SENIOR - B1, 2-Feb-12, 100 (104.25)</td>
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<td>Seat-A05, SEAT Paginegialle S.P.A., ELCDS, LIEN 1, 17-Jan-12, 145</td>
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<td>AMR, AMR Corporation, CDS, SENIOR, 15-Dec-11, 23.5</td>
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<td>PMI, &quot;The PMI Group, Inc.&quot;, CDS, SENIOR, 13-Dec-11, 16.5</td>
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<td>SPGIM, SEAT Paginegialle S.P.A., CDS, SUBORDINATED, 9-Dec-11, 10</td>
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<td>DYNHLD, &quot;DYNEGY HOLDINGS, LLC&quot;, CDS, SENIOR, 29-Nov-11, 71.25</td>
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<td>Panrico-A06, &quot;Panrico, S.L. Unipersonal&quot;, ELCDS, LIEN 1, 23-Nov-11, 8.125</td>
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<td>JVC, Victor Company of Japan, CDS, SENIOR, 9-Nov-11, 93.75</td>
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<td>IPBS, Irish Life and Permanent - August Restructuring, CDS, SENIOR - B1, 5-Oct-11, 86</td>
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<td>IPBS, Irish Life and Permanent, CDS, SENIOR - B1, 29-Jul-11, 83</td>
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<td>IPBS, Irish Life and Permanent, CDS, SENIOR - B2, 29-Jul-11, 71</td>
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<td>IPBS, Irish Life and Permanent, CDS, SENIOR - B3, 29-Jul-11, 71</td>
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<td>IPBS, Irish Life and Permanent, CDS, SUBORDINATED - B3, 29-Jul-11, 20</td>
</tr>
</tbody>
</table>
CLN: Credit Linked Note

- CLNs are structured notes, sometimes referred to as funded CDS
- Example:
  - 5Y CDS for Brazil = 200bps.
  - A brazilian bank wants to buy $100m of Brasil gvt risk.
  - You are unwilling to enter the trade because of wrong-way risk (idea that default on c/p and default on reference credit are correlated).
- Solution: CLN
  - Br bank invests $100m in SPV note paying L+200, if default gets recovery back
  - The SPV sells protection à 200 on CDS market and invests the $100m @ Libor on money-market
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CDS basis

- CDS basis = CDS level – Asset swap spread
- In theory should be 0

- Positive basis implies that the CDS spread exceeds that of the cash bond spread. Negative basis implied the opposite.

- Trades are often entered to take advantage of this basis and potential arbitrage opportunities can be found. These strategies bet on the basis returning to 0
The 5Y CDS for ABC corp. trades at 250bps. A 5y ABC bond asset swaps at 200bps

1/ What is the CDS basis?

2/ Set up the basis trade (betting on a return to 0). Draw a diagram of flows i/if there is no default ii/ in the event of default
Factors explaining positive basis

- Difficult to short bond long-term
- Repo-rate below LIBOR
- Bond trades below par
- IRS unwind (steep yield curve)
- Cheapest to deliver option
- CSO hedging
Factors explaining negative basis

- Bond trades above par
- Difficult to obtain funding
- Credit event cashflow mismatches
- IRS unwind (negative yield curve)
- CDS counterparty risk
- Synthetic CDO issuance
Evolution of the Basis

Dislocation of the market since the Crisis – August 2009

Pre – crisis :

▪ 0 bps basis on IG
▪ +20 bps on HY

High Yield showed negative basis of 400 bp to 900 bp (z spread) in 2009, usually possible because of forced sellers

In Summer 2010 good negative basis trades for lower Tier 2 bank debt with 250 bp negative basis
Evolution of the Basis

Interesting to put the trade on from 200 bp up

Now basis is negative as a rule but with levels close to pre Lehman:

- 30bps on IG
- 50 to -70 bps on HY
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Credit indices

- **Bond indices**
  - Used primarily as benchmark for performance measurement
  - Interest rate as well as credit components (the former tends to dominate long-term)

- **CDS indices – CDX, iTraxx**
  - Pure credit indices
  - Broad range of indices: Sovereign, IG/HY/Crossover Corporates, Sector, Regional etc…
  - Maturities 3, 5, 7, 10y
  - Example:
    - CDX: Equally weighted basket 125 most active US Investment Grade names
    Buying $100m of the index is equivalent to purchasing protection on $0.8m of each of the 125 constituents
CDS indices - Products

Can be traded:
- CDS index
- Options on Index
- Index tranches
iTraxx Indices

iTraxx Europe :
- 125 equi weighted CDS (0.8%)
- «investment grade» rated
- Satisfying sectorial and liquidity criteria

iTraxx « Hi Vol » :
- 30 CDS
- Highest spreads out of iTraxx Europe

iTraxx « Crossover » :
- 50 CDS
- The reference entities are European excluding financial sectors
- Maximum rating « Crossover » (i.e. Baa3/BBB- with a negative outlook)

Sectorial iTraxx’
CDS indices - Uses

Directional positions on:
- Market credit risk
- Industry credit risk
- Long / Short

Liquidity
- Size on a diversified credit pool
- New participants: hedge funds, capital structure arbitrageurs

Transparency

CVA Desks

Diversification (diversified portfolio of credit risk)
Introduction to iTraxx

iTraxx is a pool of liquid and equi-weighted Credit Default Swaps (CDS)

- The composition is decided by market makers according to the liquidity of each CDS during the past 6 month
- New series of indices are issued every six month
- With iTraxx, the buyer of protection protects himself against default risk of the reference entities of the CDS composing the index
- In case of credit incident, the defaulting entity is withdrawn from the index, the contract continuing trading till maturity with a lower notional amount
ITraxx End Users

Markit iTraxx Europe
- HiVol
  - High Beta

Markit iTraxx Europe
- Diversity

Markit iTraxx Europe
Crossover
- High Yield

Asset Managers
Hedge Funds
Bank Proprietary Desks
Media
Corporate Treasury
Insurance
Bank Portfolio Managers
Correlation Trading Desks

Tranched iTraxx
- Exposure to five standard tranches of iTraxx Europe
  - 0-3% 3-6% 6-9% 9-12% 12-22%

iTraxx Options
- Options on the spread movement of iTraxx indices

iTraxx Futures
- iTraxx Europe
- iTraxx HiVol
- iTraxx Crossover
Markit Europe Process

- **Transparent process**
  - Rules based construction based on CDS volumes published by DTCC
  - Information is freely available on Markit website
  - New series of iTraxx Europe issued every 6 months (March & September)
  - Administered by Markit
  - For detailed rules see [www.markit.com](http://www.markit.com)

- **Process overview**

  ![](image)

  - **CDS trading volumes observed from DTCC TIW**
  - **Rules applied**
  - **Provisional membership**
  - **Entities and reference obligations**
  - **Final membership list**
  - **Coupon levels**
  - **Trading begins**

  Rules-based construction based on CDS volumes from DTCC TIW
  Index rules applied to each index family
  Published on website
  Agreed by participating dealers
  Published on website
  Agreed by participating dealers
  On 20 March / September
Index series of iTraxx Europe

Benchmark indices

iTraxx Europe
Top 125 names in terms of CDS volume traded in the six months prior to the roll

iTraxx Europe HiVoI
Top 30 highest spread names from iTraxx Europe

iTraxx Europe Crossover
Exposure to 50 European sub-investment grade reference entities

Sector indices

Non-Financials
100 entities

Financials Senior
25 entities

Financials Sub
25 entities
Quotation of iTraxx Europe

Quotation in basis points

Spread = average of 125 Credit Default Swap spreads

Paid as quarterly coupons

Established norms:
- Standardised documentation based on ISDA norms
- Defined maturities
### iTraxx Europe - Coupons / Fixed Rates

<table>
<thead>
<tr>
<th>iTraxx Europe Series 7 Coupons</th>
<th>Years</th>
<th>Maturity</th>
<th>Coupon bps</th>
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<tbody>
<tr>
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<td>20</td>
</tr>
<tr>
<td></td>
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<tr>
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<td>5</td>
<td>20-Jun-12</td>
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<tr>
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### iTraxx Europe Series 7 Recovery Rates

<table>
<thead>
<tr>
<th>Recovery Rates %</th>
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</thead>
<tbody>
<tr>
<td>ITraxx Europe</td>
</tr>
<tr>
<td>ITraxx Europe HiVol</td>
</tr>
<tr>
<td>ITraxx Europe Non-Financials</td>
</tr>
<tr>
<td>ITraxx Europe Senior Financials</td>
</tr>
<tr>
<td>ITraxx Europe Subordinated Financials</td>
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<tr>
<td>ITraxx Europe Crossover</td>
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### iTraxx Europe Series 11 Coupons

<table>
<thead>
<tr>
<th>Years</th>
<th>Maturity</th>
<th>Coupon (bps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>20-Jun-12</td>
<td>200</td>
</tr>
<tr>
<td>5</td>
<td>20-Jun-14</td>
<td>185</td>
</tr>
<tr>
<td>7</td>
<td>20-Jun-16</td>
<td>170</td>
</tr>
<tr>
<td>10</td>
<td>20-Jun-19</td>
<td>150</td>
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</tbody>
</table>

### iTraxx Europe Crossover

<table>
<thead>
<tr>
<th>Years</th>
<th>Maturity</th>
<th>Coupon (bps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>20-Jun-12</td>
<td>1100</td>
</tr>
<tr>
<td>5</td>
<td>20-Jun-14</td>
<td>975</td>
</tr>
<tr>
<td>7</td>
<td>20-Jun-16</td>
<td>880</td>
</tr>
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<td>20-Jun-19</td>
<td>820</td>
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### iTraxx Europe HiVol

<table>
<thead>
<tr>
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<th>Coupon (bps)</th>
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<tbody>
<tr>
<td>3</td>
<td>20-Jun-12</td>
<td>425</td>
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<td>5</td>
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<td>7</td>
<td>20-Jun-16</td>
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<td>10</td>
<td>20-Jun-19</td>
<td>325</td>
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### iTraxx Europe Non-Financial

<table>
<thead>
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<th>Maturity</th>
<th>Coupon (bps)</th>
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<tr>
<td>5</td>
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<td>180</td>
</tr>
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<td>20-Jun-19</td>
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</table>

### iTraxx Europe Senior Financials

<table>
<thead>
<tr>
<th>Years</th>
<th>Maturity</th>
<th>Coupon (bps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>20-Jun-14</td>
<td>210</td>
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<tr>
<td>10</td>
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<td>190</td>
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### iTraxx Europe Sub Financials

<table>
<thead>
<tr>
<th>Years</th>
<th>Maturity</th>
<th>Coupon (bps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
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<td>375</td>
</tr>
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<td>10</td>
<td>20-Jun-19</td>
<td>350</td>
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### iTraxx Europe Series 11 Recovery Rates

<table>
<thead>
<tr>
<th>Recovery Rates %</th>
</tr>
</thead>
<tbody>
<tr>
<td>iTraxx Europe</td>
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<tr>
<td>iTraxx Europe Crossover</td>
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<tr>
<td>iTraxx Europe HiVol</td>
</tr>
<tr>
<td>iTraxx Europe Non-Financial</td>
</tr>
<tr>
<td>iTraxx Europe Senior Financials</td>
</tr>
<tr>
<td>iTraxx Europe Sub Financials</td>
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</table>
### iTraxx Series 17 | March 2011

#### Markit iTraxx Europe Series 17 Coupons

<table>
<thead>
<tr>
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<th>Year</th>
<th>Maturity</th>
<th>Coupon (bps)</th>
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<td></td>
<td>7</td>
<td>20-Jun-19</td>
<td>100</td>
</tr>
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<td></td>
<td>10</td>
<td>20-Jun-22</td>
<td>100</td>
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<tr>
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</tr>
<tr>
<td></td>
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<td>20-Jun-17</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>7</td>
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<td>500</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>20-Jun-22</td>
<td>500</td>
</tr>
<tr>
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<td>100</td>
</tr>
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<td></td>
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</tr>
<tr>
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<td>10</td>
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<td>100</td>
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<tr>
<td></td>
<td>10</td>
<td>20-Jun-22</td>
<td>100</td>
</tr>
<tr>
<td>Markit iTraxx Europe Senior Financial</td>
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<td>20-Jun-17</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>20-Jun-22</td>
<td>100</td>
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<td>500</td>
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<tr>
<td></td>
<td>10</td>
<td>20-Jun-22</td>
<td>500</td>
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</table>

#### Markit iTraxx Europe Series 17 Recovery Rates

<table>
<thead>
<tr>
<th>Index</th>
<th>Recovery Rates %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markit iTraxx Europe</td>
<td>40</td>
</tr>
<tr>
<td>Markit iTraxx Europe Crossover</td>
<td>40</td>
</tr>
<tr>
<td>Markit iTraxx Europe HiVol</td>
<td>40</td>
</tr>
<tr>
<td>Markit iTraxx Europe Non-Financial</td>
<td>40</td>
</tr>
<tr>
<td>Markit iTraxx Europe Senior Financial</td>
<td>40</td>
</tr>
<tr>
<td>Markit iTraxx Europe Sub Financial</td>
<td>20</td>
</tr>
</tbody>
</table>
iTraxx Eur 5 Y 21/05/12
iTraxx Crossover 5 Y 4 Nov 2011
iTraxx SovX WE 20 May 2012
iTraxx | Impact of a credit event

The counterparty sells protection for 10 m€ of iTraxx Europe notional as CDS. Spread at issue = 30 bp pa

No credit event

Quarterly payments
Credit event: physical delivery
- Credit event occurred in the 3rd year
- Weight of the reference entity: 0.8%

At occurrence of credit event
- Counterparty: Seller of protection
- Notional of deliverable bond: 80,000 €
- Market Maker: Buyer of protection
- 0.8% of 10 m €

After occurrence of event: notional amount decreased by 0.8%
- Counterparty: Seller of protection
- 30 bps x 10 m € x (1-0.8%)
- Market Maker: Buyer of protection
- 30 bps x (99.2%)
**t₀ : iTraxx Europe 5 years issued at 30bp**

**t₁ = t₀ + 2j** iTraxx Europe 5 years trades at 28 bps

Counterparty sells protection on iTraxx Europe for €10M (= buys the iTraxx)
Index Skew

Difference between Index market spread and Index theoretical value

Index Skew = Actual Index Spread – Fair value Index Spread

You can efficiently trade the movement of the skew by finding a replica CDS portfolio that consists of a fewer number of liquid credits that closely follow the movement of the fair spreads for the underlying portfolio of the index.
Case Study: JP Morgan ‘Whale’
Credit Derivatives

1. Credit concepts
2. CDS mechanics and uses
3. CDS basis
4. CDS indices
5. First-To-Default baskets
6. Structured Credit
Correlation

- Correlation measures how 2 securities move in relation to one another
- Stock or asset price correlation is used for diversification purposes
  - To improve risk/return ratios of the portfolio
  - See CAPM portfolio theory where returns are assumed to be normally distributed
- In credit markets, we look at default correlation: the correlation between the defaults (or more precisely the time to default) of 2 credits
Default Correlation

The default correlation measures the probability that 2 or more credits default at once. Generally speaking, correlation measures the impact of one default on the spreads of other credits.

**High Correlation**

- Portfolio with strong geographical and/or sector concentration, thus exposed to systemic risk. The probability of a high default rate is higher.

**Low Correlation**

- Well diversified portfolio, exposure to a large number of sectors, but with low concentration of risk.
AIG had exposure to 500bn of baskets (high tranches e.g. 4TD -> were short correlation)
First to Default Baskets

The buyer of protection through a FTD swap
– pays a contractual premium
– in return for a promise from the protection seller to make payment on the first credit in a pre-specified basket that experiences a credit event

The buyer of risk to receives a leveraged return on a basket of credits

FTD Protection Seller

FTD Premium = 160 bps

Contingent payments on First credit event

FTD Protection Buyer

Reference Credits

Credit 1
45 bps

Credit 2
40 bps

Credit 3
50 bps

Credit 4
75 bps

Avg. Spread = 52.5 bps
The hedging is based on single-name spreads, recovery rates (here, 40%) and default correlation (here, 50%).
A default event on Volkswagen (for instance) would induce a general spread widening.
Hedging a FTD

A default event on Volkswagen (for instance) would induce a general spread widening

- 100 bps widening
  → Loss on defaulted position
    \[(10M - 7.29M) \times (1-R) = 1.63M\]
  + Profit on residual hedge \([18.77M \times 1\% \times \text{Annuity Price} \sim 0.83M]\)
  → P&L = -0.80M

- 200 bps widening
  → Loss on defaulted position
    \[(10M - 7.29M) \times (1-R) = 1.63M\]
  + Profit on residual hedge \([18.77M \times 2\% \times \text{Annuity Price} \sim 1.66M]\)
  → P&L = +0.03M

- Breakeven spread widening = 197 bps
Hedging a FTD

FTD may be gamma positive or negative

Gamma >0 : Its delta decreases with a global spread widening
Gamma <0 : Any idiosyncratic risk would induce a higher delta on the specific name

<table>
<thead>
<tr>
<th>Underlyings</th>
<th>+1%</th>
<th>+10Bps</th>
<th>Specific</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cds Spreads</strong></td>
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<td></td>
</tr>
<tr>
<td>VALEO</td>
<td>0.45</td>
<td>0.495</td>
<td>0.55</td>
</tr>
<tr>
<td>PEUGEOT</td>
<td>0.4</td>
<td>0.44</td>
<td>0.5</td>
</tr>
<tr>
<td>RENAULT</td>
<td>0.5</td>
<td>0.55</td>
<td>0.6</td>
</tr>
<tr>
<td>VOLKSWAGEN</td>
<td>0.75</td>
<td>0.825</td>
<td>0.85</td>
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</table>

<table>
<thead>
<tr>
<th>Hedge Ratios</th>
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</thead>
<tbody>
<tr>
<td>VALEO</td>
<td>62.6%</td>
<td>61.3%</td>
<td>60.8%</td>
</tr>
<tr>
<td>PEUGEOT</td>
<td>60.5%</td>
<td>59.2%</td>
<td>59.0%</td>
</tr>
<tr>
<td>RENAULT</td>
<td>64.6%</td>
<td>63.4%</td>
<td>62.5%</td>
</tr>
<tr>
<td>VOLKSWAGEN</td>
<td>72.9%</td>
<td>72.0%</td>
<td>69.9%</td>
</tr>
</tbody>
</table>
Hedging a FTD

The FTD is long correlation

When correlation increases

- → MTM moves up
- → Single-name deltas increases on the riskiest names and decreases on the others.

<table>
<thead>
<tr>
<th>Correlation</th>
<th>50%</th>
<th>60%</th>
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<tbody>
<tr>
<td>Cds Spreads :</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VALEO</td>
<td>0.45</td>
<td>0.45</td>
</tr>
<tr>
<td>PEUGEOT</td>
<td>0.4</td>
<td>0.4</td>
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<tr>
<td>RENAULT</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>VOLKSWAGEN</td>
<td>0.75</td>
<td>0.75</td>
</tr>
<tr>
<td>Hedge Ratios :</td>
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<tr>
<td>VALEO</td>
<td>62.6%</td>
<td>55.9%</td>
</tr>
<tr>
<td>PEUGEOT</td>
<td>60.5%</td>
<td>53.2%</td>
</tr>
<tr>
<td>RENAULT</td>
<td>64.6%</td>
<td>58.4%</td>
</tr>
<tr>
<td>VOLKSWAGEN</td>
<td>72.9%</td>
<td>73.0%</td>
</tr>
</tbody>
</table>
FTD - Summary

The FTD tranche holder is:

- long correlation
- Gamma positive for systemic events
- Gamma negative for specific events
Systemic vs. idiosyncratic risk

Source: JP Morgan
Credit Tranches

CDS indices provide exposure to the default risk across a pool of credits.

A tranche offers access to the risk of a specified amount of loss on a given portfolio of credits.
Credit Tranches

Pricing of tranches is mainly driven by 2 interrelated components:

- The expected loss within the underlying portfolio as implied by its quoted spread
- The default correlation among the reference credits

![High correlation graph]

![Low correlation graph]
Tranche seniority and correlation

Correlation is up = Increase of systemic risk
→ Widening of the senior spread
  • Senior tranche is short correlation

Expected loss is unchanged
→ Tightening of the equity spread
  • Equity tranche is long correlation
Great liquidity has developed in 5 year, 7 year, 10 year IG / HY index tranches

**iTraxx Europe**
125 Names
Trades @ 45 bps

<table>
<thead>
<tr>
<th>Attachment Points</th>
<th>Tranche</th>
<th>Bid</th>
<th>Offer</th>
<th>Delta</th>
<th>Base Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>22%-100%</td>
<td>Super Senior &quot;Plug&quot;</td>
<td>13</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12%-22%</td>
<td>Super Senior</td>
<td>32</td>
<td>34</td>
<td>1.25 x</td>
<td>77</td>
</tr>
<tr>
<td>9%-12%</td>
<td>Senior</td>
<td>52</td>
<td>54</td>
<td>1.75 x</td>
<td>62</td>
</tr>
<tr>
<td>6%-9%</td>
<td>Senior-Mezzanine</td>
<td>71</td>
<td>73</td>
<td>2.25 x</td>
<td>56</td>
</tr>
<tr>
<td>3%-6%</td>
<td>Mezzanine</td>
<td>149</td>
<td>152</td>
<td>4.5 x</td>
<td>47</td>
</tr>
<tr>
<td>0%-3%</td>
<td>Equity</td>
<td>21.53</td>
<td>22.17%</td>
<td>13.25 x</td>
<td>32</td>
</tr>
</tbody>
</table>

Tranches on iTraxx Main S8 12/20/2012, as of 11/9/2007. Prices are for illustrative purposes only.

Reference index @ 45 bps. Equity trades upfront + 500bps running spread
Credit Derivatives

1. Credit concepts
2. CDS mechanics and uses
3. CDS basis
4. CDS indices
5. First-To-Default baskets
6. Structured Credit
Fundamentally, structured credit makes the assumption that credit spreads overcompensate for credit risk.

- Default Risk Premium
- Volatility Risk Premium
- Liquidity Risk Premium
- Expected Default Default Loss

Credit Spread

- Diversified
- Diversifiable
- Systematic

Default Premium Compensates for Unexpected Loss
Arbitrage CDOs

Vehicles that rely on low-rated debt securities as collateral and issue highly-rated liabilities.

Structured to make advantage from the gap separating credit spreads and expected losses.

To issue AAA-rated notes, a part of the collateral is set aside to created the subordination to absorb (almost) all defaults.

<table>
<thead>
<tr>
<th>Collateral</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBB Bonds</td>
<td>AAA Senior</td>
</tr>
<tr>
<td>Spread = 160 bps</td>
<td>Issued @ 50 bps</td>
</tr>
<tr>
<td>DP = 0.6% p.a.</td>
<td></td>
</tr>
<tr>
<td>Recovery = 50%</td>
<td></td>
</tr>
<tr>
<td>$\Rightarrow$ EL = 0.30%</td>
<td></td>
</tr>
</tbody>
</table>

Recovery = 50%
A CDO is comparable to a bank’s balance sheet
- It borrows money by issuing liabilities
- It invests in collateral (a pool of credits) when banks make loans to consumers / corporations
- Only residual cash flows from the collateral are paid to equity
Static Synthetic CDO

The entire capital structure may be issued

Protection bought on the entire capital structure

Hedging

Name 1
Name 2
Name 3
Name 4
.
.
.
Name N

Dealer

Super Senior

Senior

Mezzanine

Equity

Investors

Protection Selling
We may also prefer to issue a single bespoke tranche

The dealer is now exposed to correlation risk (if the entire capital structure is issued, delta=1 i.e. no risk to dealer)