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INTRODUCING BOND SPREADS, DURATION & CONVEXITY

Global Credit Derivative and Index Research

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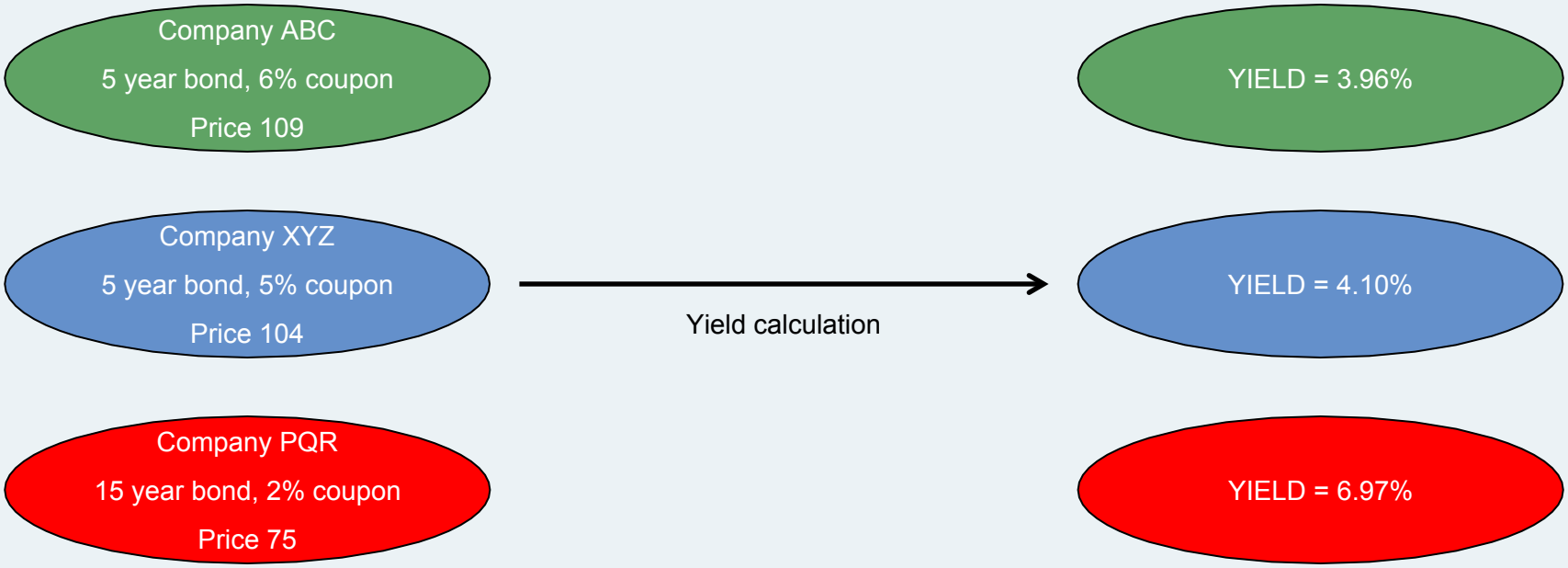
Bond prices and yields

Bond pricing

- The yield of a bond is the average return on investment from buying a bond.
- The price of a bond can be expressed in terms of its yield:

$$\boldsymbol{Price} = \frac{C}{1+\boldsymbol{y}} + \frac{C}{(1+\boldsymbol{y})^2} + \frac{C}{(1+\boldsymbol{y})^3} + \ldots + \frac{100+C}{(1+\boldsymbol{y})^T}$$

- Higher yield ➔ lower prices.
- Yields allows us to easily compare bonds with different coupons, prices and maturities.



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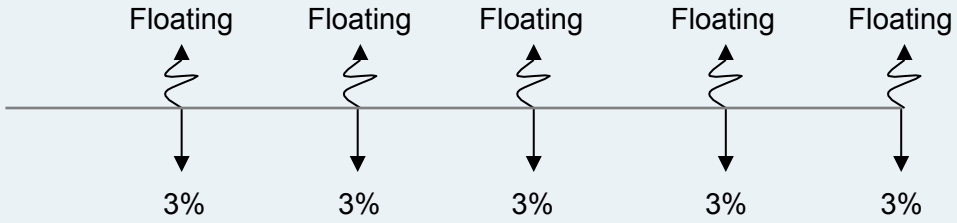
Interest rate swaps

Swaps

- Interest rate swaps allow investors to convert floating-rate cash flows to fixed-rate cash flows.
- e.g. for 5y swap we pay fixed rate of 3% every year for five years and receive floating rate payments based upon some reference rate (EURIBOR/SONIA/SOFR/LIBOR).
  - Future floating rate levels are not yet known – 3% rate is the market's expectation of the average floating rate over the life of the contract.



- Reference rates for swaps are changing. LIBOR is being replaced by new RFRs (SOFR in the US, SONIA in the UK) while EURIBOR in Europe is unchanged.
- LIBOR has historically been seen as average short-term borrowing rate for AA- rated banks; for financial investors looking to borrow money and invest in higher yielding assets will benchmark themselves to this level.
- Credit instruments are often compared to the swaps rate to ascertain how much relative yield they offer.

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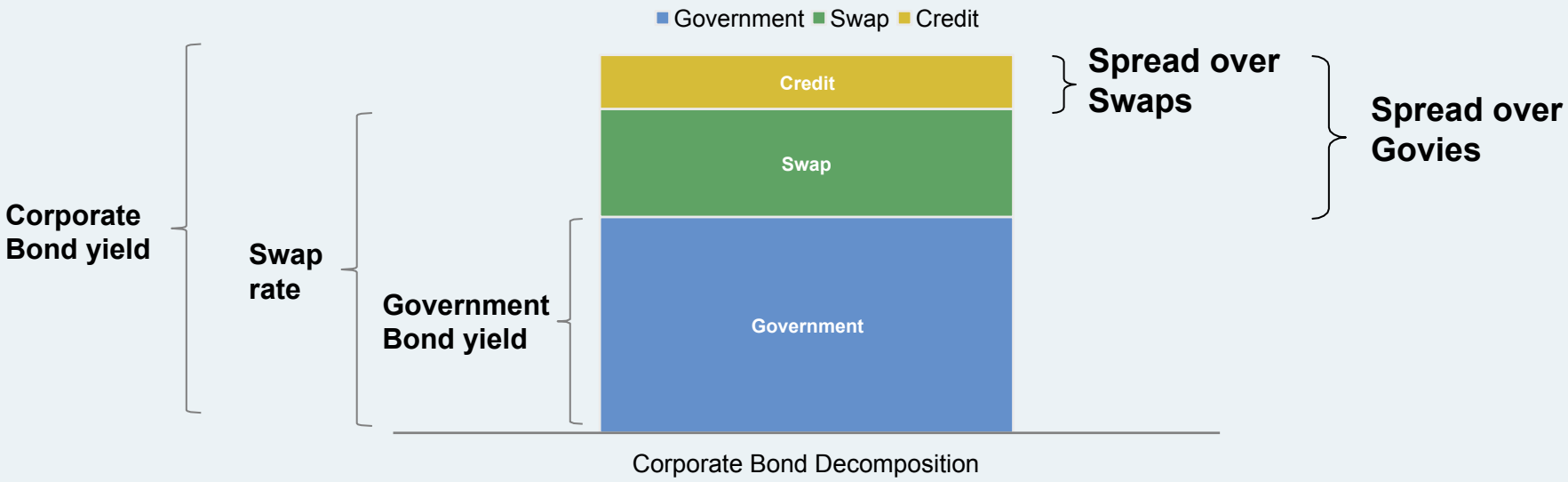
Components of a corporate bond yield

Corporate bond yields

- The yield is the return for taking on the risk of holding a (corporate) bond
  - For corporate bonds we can break this down into three components
- Each component represents a different risk/reward of the bond
  - The spread is the additional return for taking on additional risk



- Credit spreads can be to government or swaps (i.e. to a given "risk-free" curve")
  - Swaps are based on interbank lending of generic AA banks (RFRs)
  - Swaps convert floating reference rates to fixed rates

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Why we only care about spreads

Yields and Spreads

- Why can't we just use yields?
  - Yield changes can be driven by any one of the three components: government, swap or credit
  - We want to **isolate the credit risk** - i.e. the credit spread
  - Historically yields have been dominated by the risk-free component but since 2008 credit spreads have been a much larger driver.
- For example
  - Company ABC has a bond with a yield of 6%
  - Central bank raises interest rates leading to a 1% rise in government bond yields
  - Company ABC's bond now has a yield of 7%
  - Why has the bond price declined?
    - Company credit quality is unchanged
    - Yield change is due to government yield change
- **Yield changes alone do not tell us about credit quality**

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Credit and risk-free rates

Risk-free rates

- Credit spreads are always quoted with respect to a risk-free benchmark.
- "Risk-free" can be quite subjective and depends on the investor. Typically there are two broad types of risk-free rates:
  - **Government bonds**: Mostly used by clients who are given cash to invest and do not have to borrow funds e.g. asset managers, pension funds, insurance companies.
  - **Interest rates swaps**: Mostly used by clients who borrow money to fund themselves; LIBOR swaps historically represented borrowing rate for banks and other financial institutions. e.g. Bank desks, hedge funds.
- Neither government bonds nor interest rate swaps are truly risk free; from a credit point of view we are most interested in them for comparison purposes.

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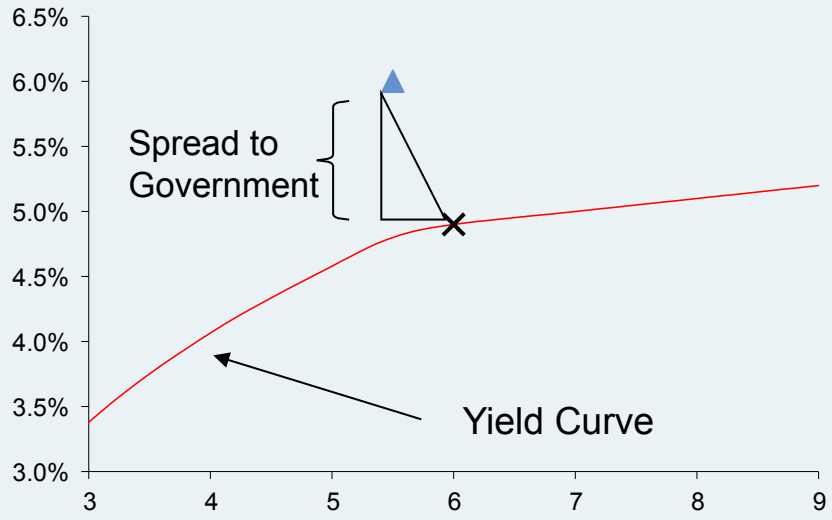
1. Spread to Government

Spread to Govt

- Spread to government is the difference in yield between a corporate bond and a government bond of a similar maturity.
- Example: Verizon 5.5y $ bond — Yield: 6% (600bp)
  US Treasury 6y $ bond — Yield: 4.9% (490bp)
  Spread to govt: 110bp
- Advantages:
  - Easy to calculate and quote
  - Good benchmark for real money investors
- Disadvantages:
  - Maturity mismatch
  - Doesn't take structure of payments into account.



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2. Interpolated Government Spread

Interpolated Spread to Govt (G-Spread)

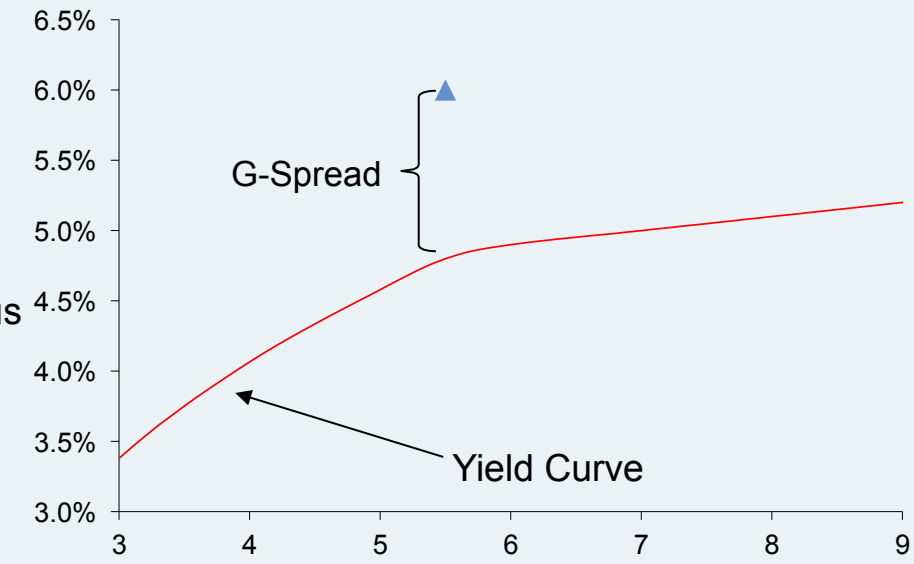
- Instead of calculating the difference between the corp bond yield and the yield of the nearest govt bond, we interpolate along the govt yield curve to calculate the yield that a govt bond would trade with if it had the exact same maturity as the corporate bond.

- Example:

Verizon 5.5y bond	Yield:	6%	(600bp)
US Treasury 5y bond	Yield:	4.6%	(460bp)
US Treasury 6y bond	Yield:	4.9%	(490bp)
Interpolated US 5.5y bond	*Yield:*	*4.8%*	*(480bp)*

Interpolated spread to govt: 120bp

- Advantages:
  - No maturity mismatch
- Disadvantages:
  - Doesn't take structure of payments into account.
  - Interpolation method might not be obvious



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3. Z-Spreads

Z-Spreads

- We can calculate "risk-free" present value for a bond using the swaps implied zero curve.

$$\boldsymbol{RiskFreePrice} = \frac{C}{1+\boldsymbol{z}_1} + \frac{C}{(1+\boldsymbol{z}_2)^2} + \ldots + \frac{100+C}{(1+\boldsymbol{z}_T)^T}$$

z_1, z_2, z_3 are zero rates implied from swaps curve

- This gives us the price of the bond if it was trading in line with the swaps market.
- Most corporate bonds are actually trading below this price as they are more risky than swaps market: we include an extra discount factor *s* so that the price matches that seen in the market.

$$\boldsymbol{TradedPrice} = \frac{C}{1+z_1+\boldsymbol{s}} + \frac{C}{(1+z_2+\boldsymbol{s})^2} + \ldots + \frac{100+C}{(1+z_T+\boldsymbol{s})^T}$$

- This *s* is known as the **z-spread**

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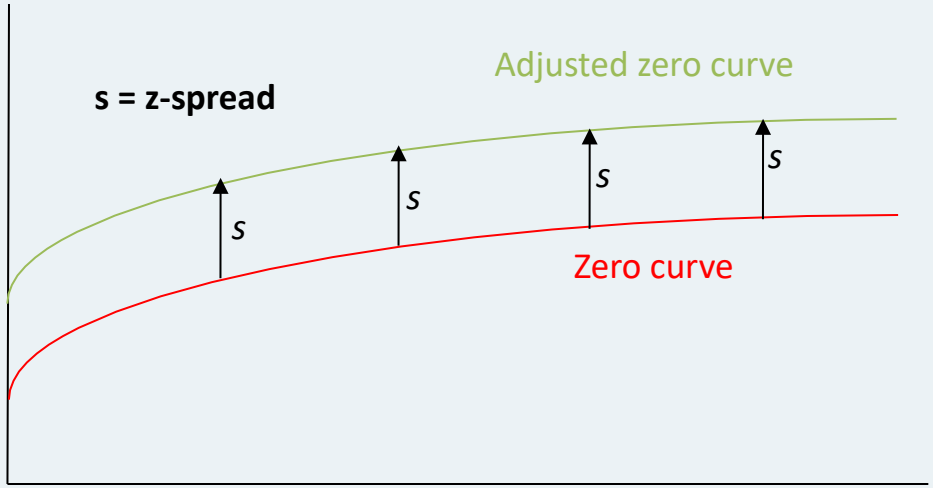
3. Z-Spreads – continued

Z-Spreads

- The z-spread is a **spread to swaps**, not a spread to government.
  - For this reason z-spreads are normally lower than government spreads as swap rates are generally higher than government yields.
- The z-spread can be thought of as the parallel shift in the zero curve required to match the market observed bond price.
- Advantages:
  - Useful spread measure for people benchmarking themselves to swaps.
  - Takes full structure of bond payments into account.
- Disadvantages:
  - Can't actually "trade" a z-spread.
  - Assumes credit spreads are flat.



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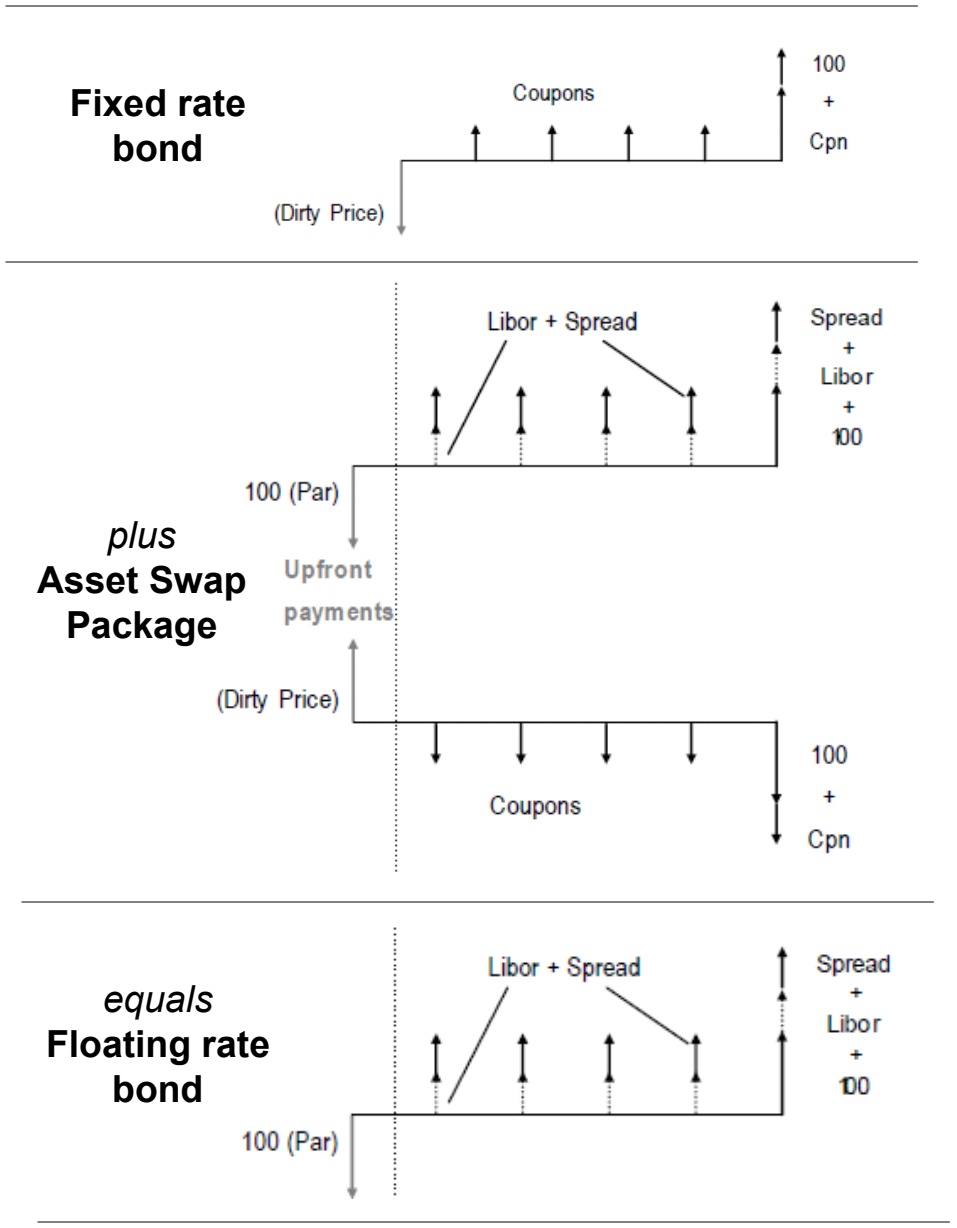
4. Asset Swap Spreads

Asset Swap Spreads

- Asset swaps let investors with fixed rate bonds convert them into bonds paying a floating rate plus a spread.
- This additional spread is known as the asset swap spread.
- The lower the bond price, the higher the asset swap spread.
- Advantages:
  - Unlike z-spreads, asset swap spreads can be traded.
- Disadvantages:
  - Asset swap spreads assume credit risk is flat.
  - Asset swap spreads can understate credit risk for riskier names due to the calculation method.
  - Similarly, they overstate credit risk for bonds trading above par



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4. Asset Swap Spreads

Calculation method

- The asset swap package turns the bond into a par-floater, by converting the coupons and the difference between bond's price over par into a running spread over the swap reference rate.
- To calculate the ASW, we need to find the spread over a swap annuity such that the present value of the floating leg equals the present value of the bond coupons plus the difference between par and the bond price:

$$\underbrace{\sum_{i}^{N_{Float}} (Swap\ Rate_i + \boldsymbol{ASW})\Delta_i DF_i}_{\text{Floating Leg PV}} = \underbrace{\sum_{i}^{N_{Coupon}} C\Delta_i DF_i}_{\text{Coupon Leg PV}} + \underbrace{100 - P}_{\text{Discount vs Par}}$$

- The solution can be approximated closely as:

$$\boldsymbol{ASW} \approx C - IRS_{rate} + \frac{100 - P}{PV01_{IRS}}$$

- This makes intuitive sense:
  - for bonds trading at par the ASW is just the difference between the bond coupon and the interest rate swap rate
  - for bonds trading away from par, the discount 100-P gives rise to an adjustment, annualised via the interest rate swap annuity

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5. Option-Adjusted Spreads

OAS

- Some bonds have embedded optionality, meaning that the market price of a bond reflects not only the value of the cash flows, but also the value of the embedded option.
- Most commonly, the option give the issuer the right to redeem the bond early.
- For example, take a 5y bullet bond with 2% coupon trading at $95, a z-spread of 200bp.
- Now, consider a second, identical bond which additionally allows the issuer to call it at 100.
  - This option is valuable to the issuer: If the bullet bond rises to a price of 105, the issuer can (and should) redeem the callable bond at 100 and re-finance at a lower coupon. The investor gets 100, but misses out on the 5 point gain he would have realised with the bullet bond.
  - The investor thus effectively sells an option to the issuer which has to be reflected in the bond's price. Let's say this option is worth $2.5, so the callable bond should have a price of $92.5.
  - Z-spreads ignore option components so the callable bond will have a wider spread of ~250bp.
  - OAS calculations effectively remove the option component before calculating the bond's spread over the risk free curve. OAS can be thought of as "option-removed" spread. In this example it should be close to 200bp, i.e. the z-spread of the straight bond.
- OAS calculation mechanics are rather involved and rely on an option pricing and interest rate evolution model. Note that by default BBG calculates OAS to sovereign benchmark curve.

Source: J.P. Morgan

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Spread recap

Bond spreads

- Corporate bond yields are made up of a number of factors, including credit spreads.
- The higher the default risk, the more spread compensation an investor will demand.
- Two broad types of credit spread for bonds:
  - Spreads based on government bonds: **Spread to govt**
    Interpolated spread to govt
  - Spreads based on interest rate swaps: **Z-spreads**
    Asset swap spreads
- Spread used will depend on type of investor and market convention.
  - Typically US use spread to government, Europe uses z-spread.
- Here we have only considered fixed coupon bullet bonds. Other spread types exist for floating rate, callable, PIK bonds etc.

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Bloomberg YAS Screen

Spread to government

Interpolated spread to government

Inter'd spread to swaps

Z-Spread

Asset Swap Spread

Option-Adjusted Spread

3-BLOOMBERG

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VW 1 ¼ 06/10/24 Corp | YAS | Related Functions Menu | Msg: +40

VW 1 ¼ 06/10/24 Corp | Settings | Yield and Spread Analysis

99.237/99.457 1.385/1.346 MSG1 @ 08:20 95) Buy 96) Sell

1) Yield & Spread 2) Graphs 3) Pricing 4) Description 5) Custom

VW 1 ¼ 06/10/24 (XS1830986326)

Spread	152.63 bp vs	DBR 1 ½ 05/15/24	
Price	99.4567	109.885	14:13:43
Yield	1.346003 Wst	-0.180284	Ann
Wkout	06/10/2024 @ 100.00	Consensus	6 6
Settle	07/10/18	07/10/18	

Risk

	Workout	OAS
M.Dur / Dur	5.659	5.741
Risk	5.634	5.716
Convexity	0.382	0.364
DV 01 on 1MM	563	572
Benchmark Risk	6.223	6.265
Risk Hedge	905 M	912 M
Proceeds Hedge	904 M	

Spreads		Yield Calculations	
11) G-Sprd	151.8	Street Convention	1.346003
12) I-Sprd	95.4	Equiv 2 /Yr	1.341504
13) Basis	12.2	Mmkt (Act/ 360)	
14) Z-Sprd	96.5	True Yield	1.345987
15) ASW	93.9	Current Yield	1.257
16) OAS	143.1		

Invoice

Face	1,000 M
Principal	994,567.00
Accrued (32 Days)	1,095.89
Total (EUR)	995,662.89

After Tax (Inc 40.800 % CG 23.800 %) 0.812944

Map cross-border equity and bond action. FOFP

Source: Bloomberg

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Spread conventions

Conventions

- Spreads always quoted in **basis points**
  - 100bp = 1%
- High grade bonds are quoted on a spread basis, not price.
  - Market of **+80/75** means that the trader will buy bonds at a spread of 80 and sell them at a spread of 75.
- Spreads are inversely related to prices – just like yields.
  - If spreads go up, prices go down.
  - If spreads go up by 1bp, then all else remaining constant we expect yields to go up by 1bp.
- Terminology:
  - **Widening**: spreads go up
  - **Tightening**: spreads do down

Source: J.P. Morgan

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What do spreads tell us?

Spreads

- For single names spread allow us to see how much default risk the market is pricing into the company and how that has changed with time.
- Single name bond spreads can be driven both by company fundamentals and by macro factors.
- We can also calculate average spreads across large numbers of bonds.
- Using these spreads we can get an impression of how much default risk is priced into the overall market.

AFFP Jul-26 ASW spread

iBoxx € Corporates ASW Spread

Source: J.P. Morgan, Markit Group

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Modified Duration

- Modified duration tells us how much our bond price changes in % terms for a 1% change in the bond yield.
  - Example:

Bond price	= 120
Modified duration	= 10
Yield rises from 4% to 5%	
Change in bond price	= % yield change x mod duration x bond price
	= -1% x 10 x 120 = -12
New bond price	= 108

- Mathematically, it is the first derivative of the bond price with respect to the yield

$$Modified\ Duration = \frac{1}{Price}\frac{\partial Price}{\partial yield}$$

- It can be represented as a weighted average of the cashflow dates, hence the name "duration".

$$\frac{\partial Price}{\partial yield} = -\left(\mathbf{1}\ x\ \frac{C}{(1+y)^2} + \mathbf{2}\ x\ \frac{C}{(1+y)^3} + \mathbf{3}\ x\ \frac{C}{(1+y)^4} + \ \ldots\ + \boldsymbol{T}\ x\ \frac{100+C}{(1+y)^{T-1}}\right)$$

- The lower the yield, and the lower the coupon, the closer the duration will be to T, the time-to-maturity.
- Modified duration can be used to calculate the price impact from spread changes as well – 1bp change in spread has same effect as 1bp change in yield (assuming rates stay constant).

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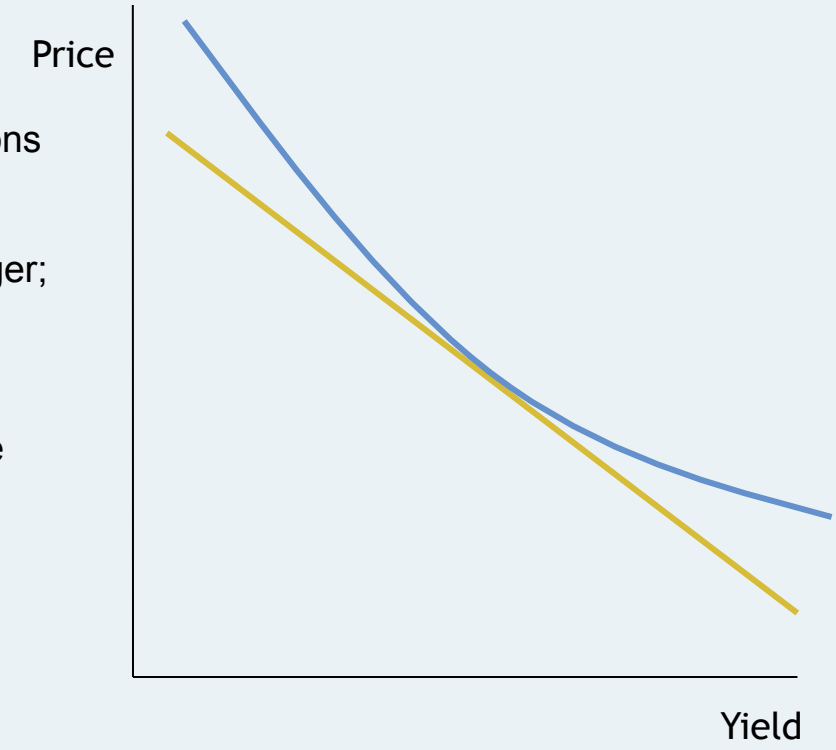
Bond convexity

Convexity

- Using modified duration to calculate price changes is only accurate for small moves.
- Durations change as yields change. This is known as **convexity** and means that the relationship between prices and yields is not a simple straight line.
- As yields increase and bond prices fall, durations decrease.
- As yields decrease and bond prices increase, durations increase.
- This makes bond losses smaller and bond gains bigger; bonds have **positive convexity**.
- Simple way to remember it – bond prices cannot go below zero however high yields go, so the bond price curve must flatten out.



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INTRODUCING CREDIT DEFAULT SWAPS

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Agenda

Introduction

CDS Mechanics

Trading CDS in Practice

Pricing Considerations and Mark-to-Market

CDS Spreads and Default Probabilities

Appendix

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What is a Credit Default Swap?

Credit Default Swaps

- Initial rationale:
  - You own a bond of company XYZ
  - If the company defaults you will suffer losses: Notional * (1 – R)
    - R: Recovery rate (price of the bond, after default, as % of notional)
  - How can you hedge those losses?
    - Selling the bond, or …
    - Buying a financial product which compensates you for the bond losses if default occurs
- **In some cases it is not possible or desirable to sell the bond.**
- Credit Default Swaps (CDS) acts like insurance for a bond or loan – if the bond defaults then CDS pays out *(1-R) x Notional* to cover bond investors' losses.
- In return for this insurance the bond holder must make regular payments.
- CDS market originated in 1990s from need of banks to hedge loan risk of major clients.

Source: J.P. Morgan

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Credit Default Swap Mechanics

Credit Default Swaps

- There are two counterparties in a CDS contract: Buyer of protection
  Seller of protection
- The protection buyer pays the protection seller regular fees – known as the **spread**.
- In return, if the underlying company defaults, the protection seller will make a payment to the protection buyer equal to (1 – Bond Recovery) x Notional.
- Each CDS contract specifies (among other things):
  - The underlying company that insurance is being bought on – the "reference entity"
  - The maturity of the contract – norm is 5 years.
  - Notional of the trade.
  - The contract spread and how this is paid, "full running" or "fixed coupon + upfront" – more later.
  - How we define a default.

Source: J.P. Morgan

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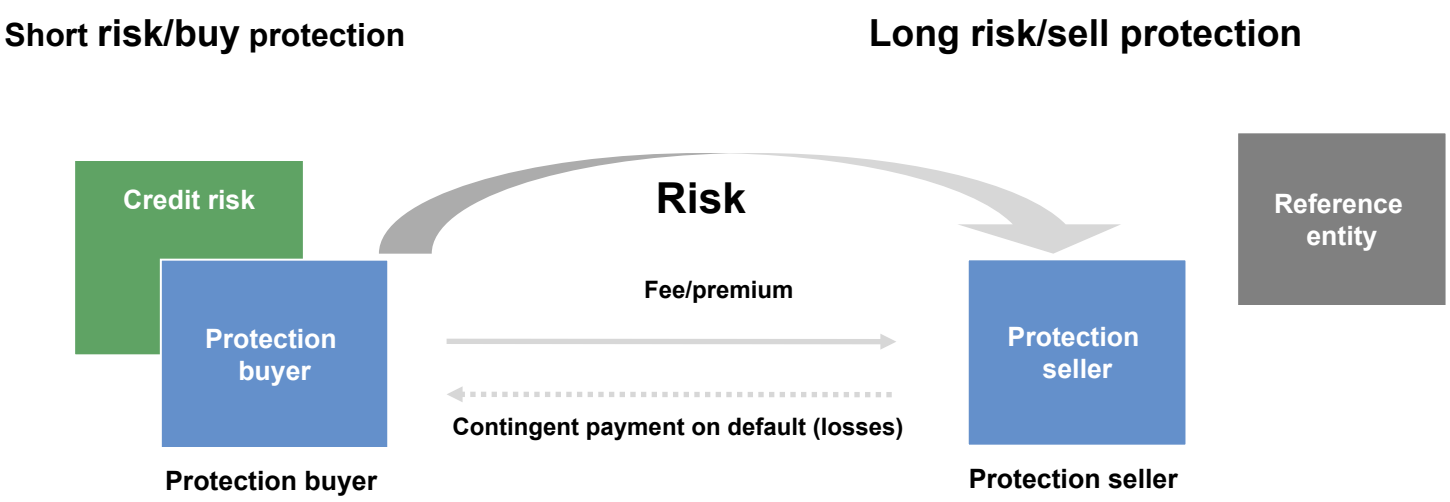
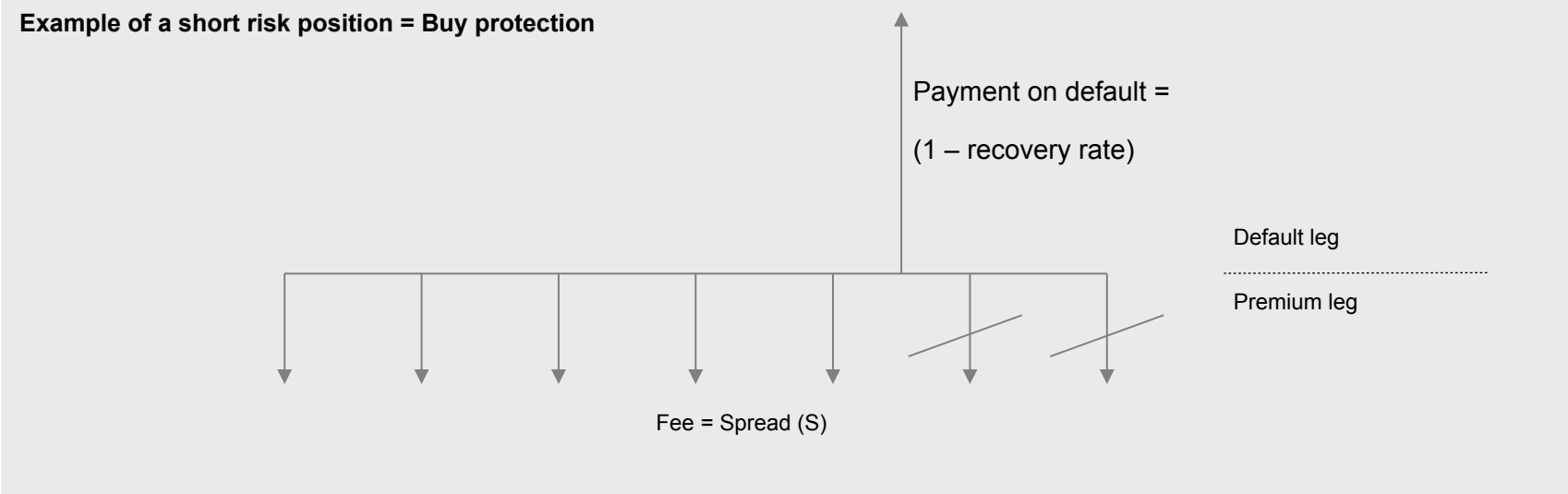
Credit Default Swap Mechanics



In cash flow terms



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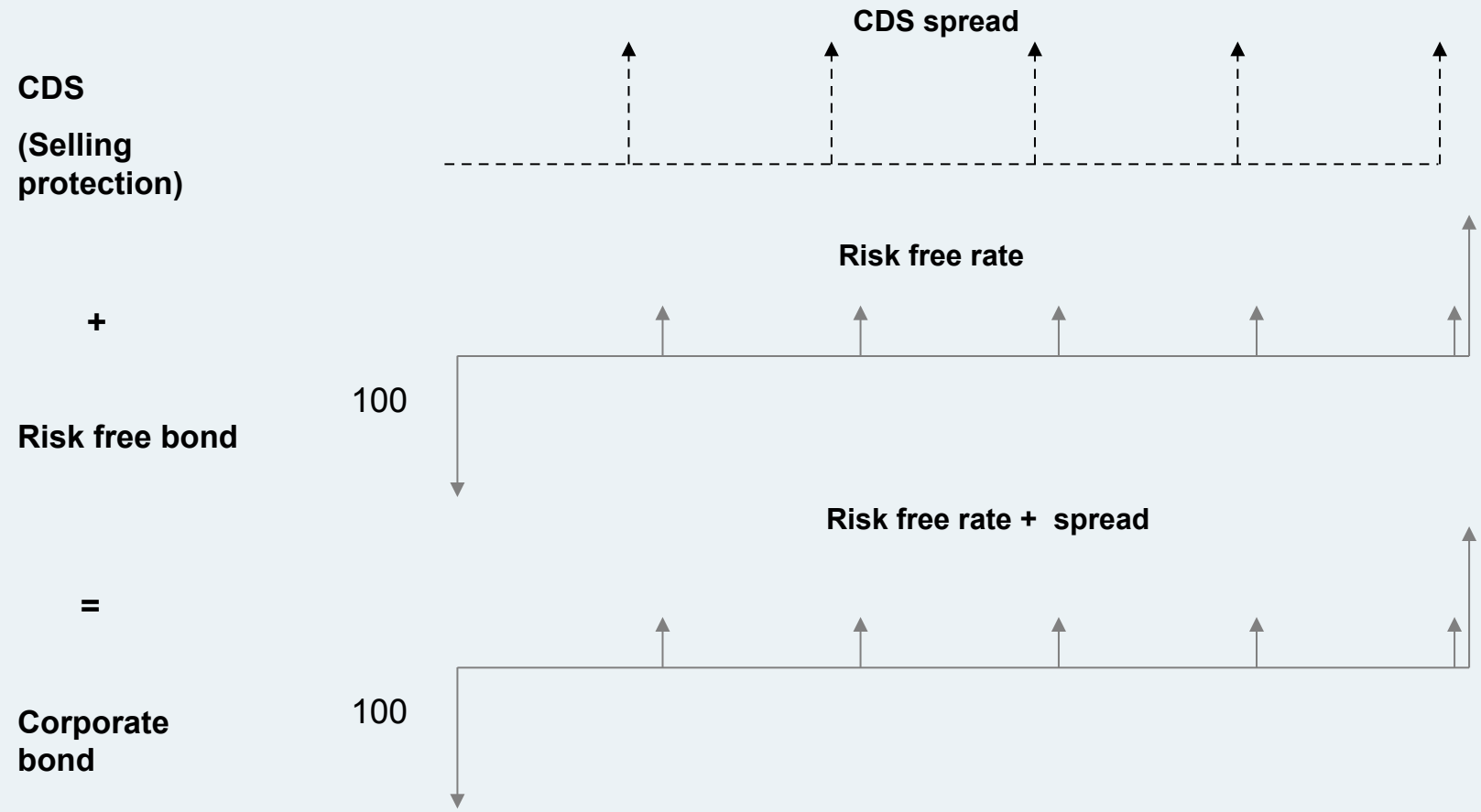
Credit Default Swap Mechanics – Bond and CDS Comparison

Credit Default Swaps



- CDS isolates the credit risk of a corporate bond.
- Corporate bond holders can similarly buy CDS protection to create a synthetic “risk-free” bond.

Source: J.P. Morgan

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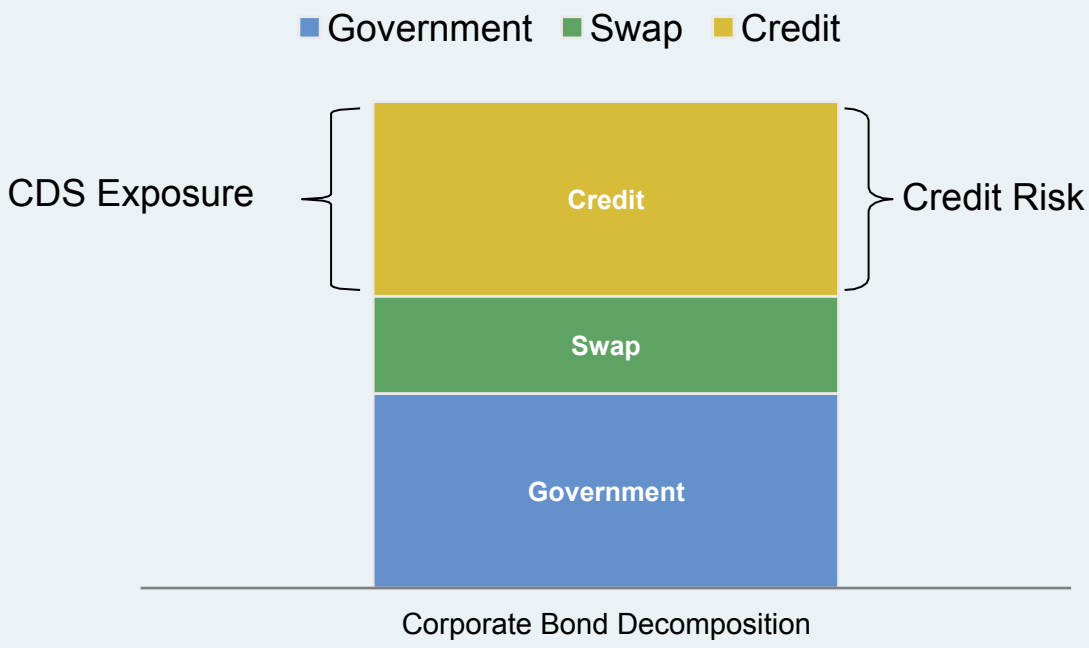
Credit default swaps and cash bond exposures

Corporate bond yield breakdown

- CDS isolates the credit risk of a bond in a single contract.
- Investors who only want to trade credit risk and not take exposure to government yields or swap rates can find credit default swaps more suited to their needs.



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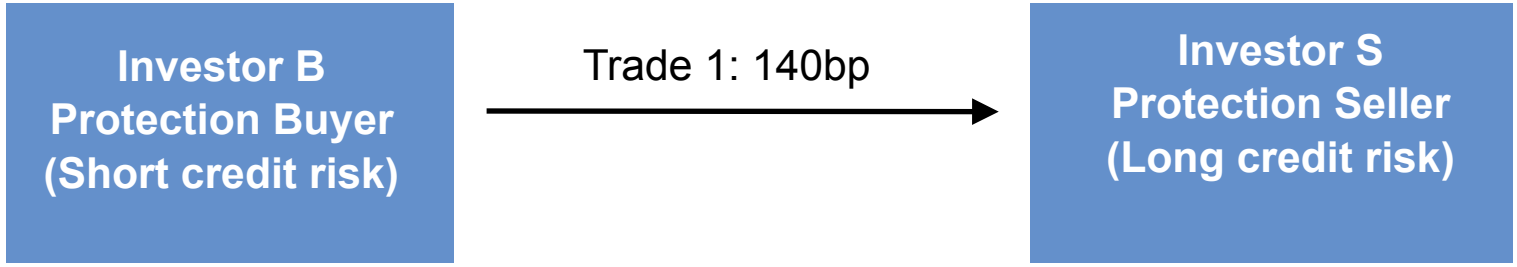
Example: Buying CDS protection (short risk) on Verizon

Verizon trade

- If investor B believes Verizon's creditworthiness will worsen, they would buy CDS protection (short credit risk),
  - paying 140bp annually, in our example
- If spreads on Verizon increase (>140bp) this benefits the investor who has bought protection
- If they decrease (<140bp) it causes the investor who has bought protection to lose money

Trade 1: Today

Investor B:	Buy CDS protection (short credit risk, pay spread)
Credit:	Verizon
Notional:	$10mm
Spread:	140bp
Maturity:	5 years (20/12/2027)



Source: J.P. Morgan

J.P.Morgan
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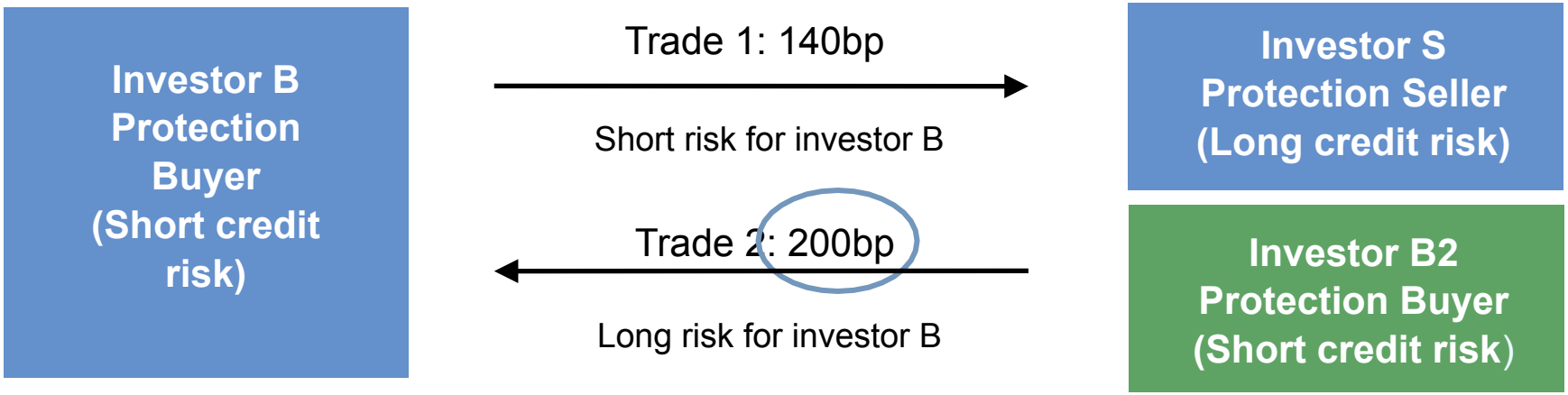
Example: Verizon credit quality worsens… its spread increases, monetise position

Exiting the trade 6 months later

- Assume that, after six months, Verizon's spread widens by 60bp to 200bp (= 140bp + 60bp)
- Investor B could enter into an opposite trade, namely sell CDS (long risk) and receive 200bp annually. They continue to pay 140bp annually, so net 60bp per year until 2027
- Alternatively, we can unwind this trade in the market
- If Verizon defaults, investor B will stop receiving the annual net 60bp. The investor has a "default neutral" position in the sense that, if there is a default, the gain in one trade (short risk) is the same as the loss in the other (long risk)

Trade 2: Unwind in 6 month

Investor B:	Sell CDS protection (long credit risk)
Credit:	Verizon
Notional:	$10mm
Spread:	200bp
Maturity:	4.5 yrs (20/12/2027)



Source: J.P. Morgan

Net annual payment to investor B = 60bp

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CDS Contracts in Practice

Standardised contracts

- Credit default swaps are “over-the-counter” (OTC) contracts.
  - Bilateral contracts between two counterparties.
  - Counterparties can use whatever terms and conditions they want.
  - Counterparties take on each other’s credit risk.
- In practice:
  - Market uses the same “standard” contract.
  - Standard contract uses ISDA 2014 Credit Derivative Definitions
  - Standard contract terms updated in 2009 – known as “Big Bang” and “Small Bang”
  - New CDS definitions came in effect in September 2014.
  - Standardisation greatly increased volumes in CDS.
  - CDS contracts are collateralised on a daily basis and are increasingly centrally cleared, reducing counterparty risk.

Source: J.P. Morgan

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CDS Contract Example

CDS Contract	
Counterparties:	JPM (seller of protection) ABC Capital (buyer of protection)
Reference Entity:	XYZ Ltd.
Maturity:	5 years
Notional:	€10 million
CDS Spread:	3% per annum
Payment Frequency:	Quarterly: March, June, September, December
Credit Events:	Bankruptcy, Failure to pay, Restructuring
Obligations:	Borrowed money
Settlement:	Cash or Physical; via a CDS auction
Deliverable Obligations:	Set of characteristics.
Reference Obligation:	Specific bond (ISIN)

Source: J.P. Morgan

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CDS Maturities and Notional

CDS Maturities

- CDS contracts are traded with standardised maturities based on semi-annual IMM dates:
  - 20th June and December of each year.
- The 5y maturity is the most liquid point. Currently the active 5y maturity is the 20 December 2027; on 20th March we will "roll" to a new contract and the 20 June 2028 contract will become the new liquid 5y point.
- All points in the curve are traded – 3M, 6M, 1Y, 2Y...10Y – but 75%+ volume is at 5y point.

CDS Notional

- Typical investment grade CDS trade size: $5mm to $20mm
- Typical high yield CDS trade size: $2mm to $10mm.
- In many cases single name CDS is more liquid than corporate bonds – there can be many bonds from one company but only one standardised 5y CDS contract.

Source: J.P. Morgan

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Credit Events and Obligations

Credit Events

- For a CDS contract to trigger a "credit event" must occur.
- Credit events fall into three main types.
  - **Bankruptcy** – covers bankruptcy filings, insolvency, appointment of administrators/liquidators for the reference entity.
  - **Failure to pay** – when the reference entity misses a coupon or principal payment on any *obligation*, taking a grace period into account.
  - **Restructuring** – a change to specific bond terms as a result of a credit deterioration. Includes reduction of principle, reduction of coupon, change to maturity, currency or seniority.
    - North American CDS contracts do not have restructuring as a separate credit event; companies usually enter Chapter 11 bankruptcy instead.
  - **Governmental Intervention (just for European Banks)** – Bail-in scenario (e.g. SNS); Includes asset-package delivery
- EU sovereigns have different credit events: Failure To Pay, Restructuring, Repudiation/Moratorium.
- Credit events are only triggered by actions on defined **Obligations**
  - Obligations typically cover "borrowed money" – e.g. bonds, loans, deposits.
  - Trade payables are <u>not</u> borrowed money.
  - Non-standard CDS contracts can have different definitions of obligations – e.g. a single bond.

Source: J.P. Morgan

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The ISDA Determinations Committee

The ISDA DC

- Some credit events are straightforward (e.g. bankruptcy filings) but some can be more subtle.
- Who decides when a credit event has taken place?
- For standardised CDS contracts, credit events are decided upon by a group called the ISDA Determinations Committee.
  - Set up in 2009 as part of the “Big Bang” changes to CDS documentation.
  - 15 members – 10 sell-side and 5 buy-side.
  - Need a supermajority of 80% to agree on a credit event for trigger.
  - If 80% majority cannot be reached, case goes to three member arbitration panel.
  - Vast majority of historical DC decisions have been unanimous.
- Market participants can submit potential credit events to DC.

Source: J.P. Morgan

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Settling CDS Trades

CDS Settlement

- Following a credit event, the protection buyer will receive a payout from the protection seller.
  - This payout is equal to (1 – bond recovery) x Notional.
  - How do we determine what recovery is?
- **Pre-2005**: All trades use bilateral physical settlement.
  - Buyer of protection gives bonds to protection seller and protection seller pays buyer par.
- **Since 2005**: Choice of physical settlement or cash settlement.
  - Auction process allows investors to physically settle and buy/sell bonds.
  - Auction process gives final recovery level – used to determine level for cash settlement.
  - **Majority of trades today are settled through cash settlement.**
- Only certain bonds/loans are eligible for physical settlement – these are known as "**deliverable obligations**".
  - The ISDA DC will publish a list of deliverable obligations prior to an auction taking place.
  - Maximum maturity of 30 years.
  - Only certain currencies allowed – EUR/USD/GBP/CHF/JPY/CAD.

Source: J.P. Morgan

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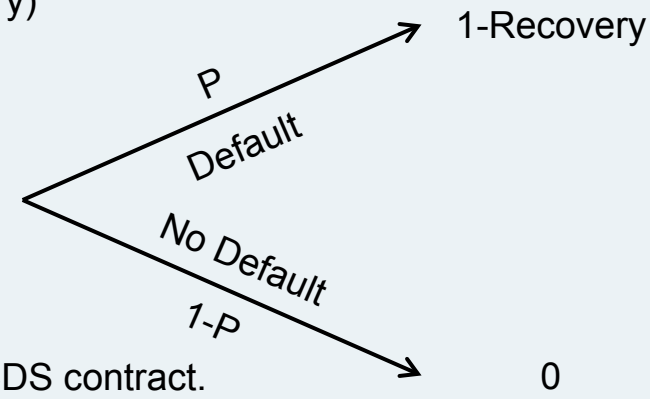
Default probabilities

- The higher the probability that a company defaults, the higher the spread that the buyer of protection will pay to enter into a CDS contract.
- What is the exact relationship between default probability and spread?
- Take a 1y CDS contract.
  - Company has *P* probability of default of having defaulted at the end of the year.
  - If company defaults, buyer of protection receives (1-Recovery)
  - If company survives, buyer of protection receives nothing.
- We can use these probabilities to calculate the expected payoff from the CDS contract.
  - Expected payoff = P x (1-R) + (1-P) x 0
    = P x (1-R)



- The buyer of protection expects to receive P x (1-R) from the CDS contract.
- For the contract to be fairly priced, the spread paid by the buyer of protection must equal the expected payoff.
- **Spread = Probability of Default x (1 – Recovery)**

Source: J.P. Morgan

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CDS Spreads and Default Probabilities - Continued

Default probabilities

- **Spread = Probability of Default x (1 – Recovery)**
- For example, if the 1y default probability is 2% and the recovery is 40% the CDS spread will be equal to 120bp (=2% x (1-40%)).
- In practice, the probabilities of default are not known but we use this relationship to back them out from market traded spreads and assumed recovery rates.

Implied Probability of Default = Traded Spread / (1 – Recovery)

- This relationship also applies for CDS contracts with maturities of longer than 1Y, but in this case the implied probability of default is the implied *annual* probability of default.
- Example:
  - 5y CDS contract
  - Spread = 500bp
  - Recovery = 40%
- Annual probability of default = 8.33% (=500bp / (1-0.4))
- In reality, relationship between default probabilities and spreads is more complicated and takes into account factors such as discounting, but the above relationship is a very good approximation.

Source: J.P. Morgan

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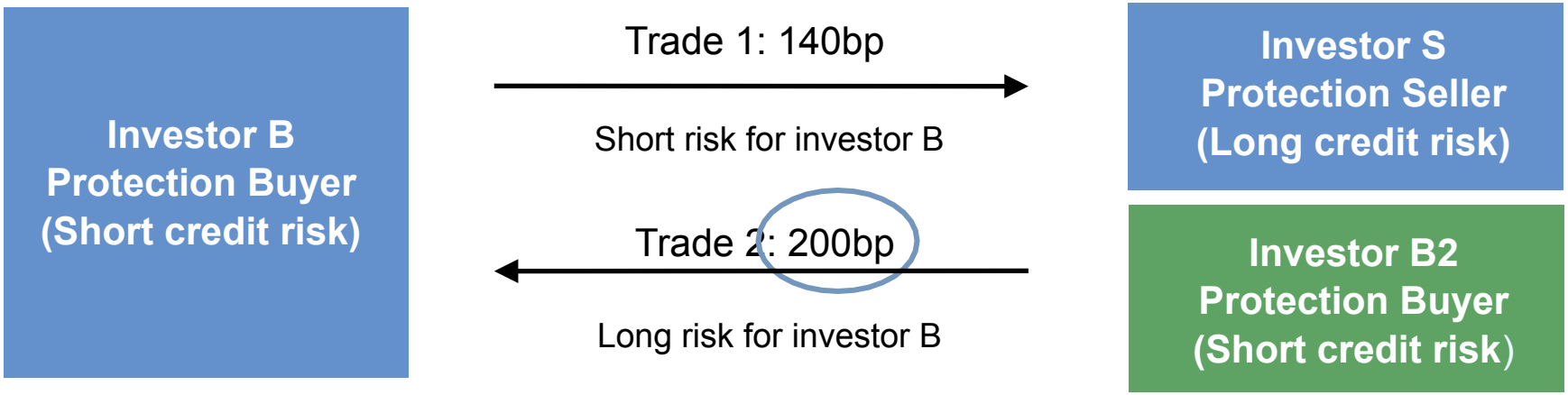
Revisiting our Verizon example

Exiting the trade 6 months later

- Assume that, after six months, Verizon's spread widens by 60bp to 200bp (= 140bp + 60bp)
- Investor B could enter into an opposite trade, namely sell CDS (long risk) and receive 200bp annually. They continue to pay 140bp annually, so net 60bp per year until 2027
- Alternatively, we can unwind this trade in the market
- If Verizon defaults, investor B will stop receiving the annual net 60bp. The investor has a "default neutral" position in the sense that, if there is a default, the gain in one trade (short risk) is the same as the loss in the other (long risk)

Trade 2: Unwind in 6 month

Investor B:	Sell CDS protection (long credit risk)
Credit:	Verizon
Notional:	$10mm
Spread:	200bp
Maturity:	5 yrs (20/12/2027)



Source: J.P. Morgan

Net annual payment to investor B = 60bp

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What is the value of 1bp?

Calculating the Risky Annuity

- We need to work out what the present value of the 60bp annual payment is to calculate our mark-to-market. We can do this by calculating the present value of a 1bp annual cashflow over the next five years – known as an annuity.
- **Example: a 1bp annuity for 5y**. We will receive 1bp every year for the next five years.
- If interest rates and default risk is zero, the PV of this annuity is worth 5.
- With non-zero interest rates, the value of later payments decreases. The new PV is 4.7.
- **What happens if the company defaults before the end of 5y?**
- If there is a default in the reference entity, we stop receiving the net 60bp coupon every year. Therefore, the probability of receiving each 60bp payment is less than 100% and is linked to the riskiness of the company.
- We need to take the possibility that the company might default and we might not receive later payments into account when calculating the PV of this annuity.
- When credit risk is taken into account (the risk of not actually receiving some payments), the expected value of later payments decreases further. The new PV is 4.5.

This PV is called the **risky annuity** and is very important in valuing CDS contracts.

Source: J.P. Morgan

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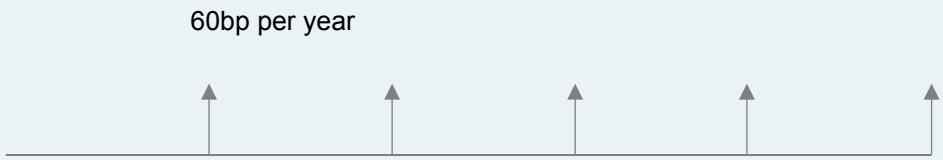
Risky Annuity

What is the present value of an annual 60bp cashflow lasting 5y?

Non-Risky Zero Interest Rate World

PV = 60bp x 5

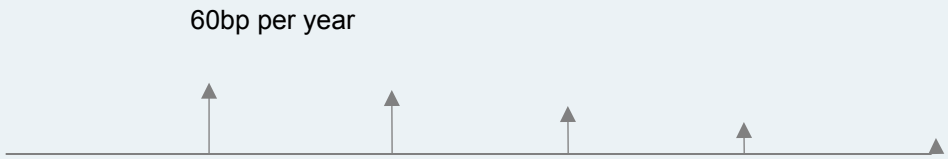
PV = 300c = 3%



Non-Risky Non-Zero Interest Rate World

PV = 60bp x 4.7

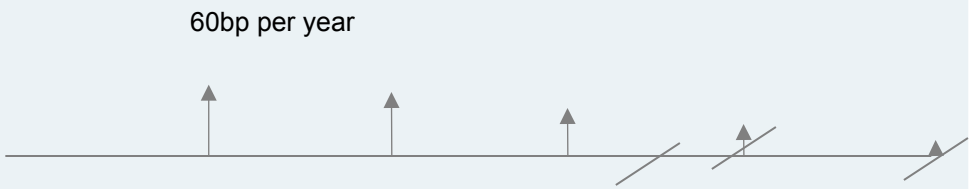
PV = 282c = 2.82%



Risky Non-Zero Interest Rate World

PV = 60bp x 4.5

PV = 270c = 2.7%



Source: J.P. Morgan.

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Calculating the Mark-to-Market on Full Running Spread trades

Verizon MTM

- For our Verizon trade we bought protection at 140bp and sold protection at 200bp six months later.
- We are receiving net 60bp from this trade.
- To mark this trade to market we need to calculate the present value of this 60bp.
- Mark to market = Risky Annuity x (Exit Spread – Entry Spread) x Notional
  = 4.5 x (200bp – 140bp) x $10mm
  = $270,000
- This 60bp net coupon is worth $270,000 to us today.
- To calculate full P&L for this trade we also need to calculate the carry we have paid up until now.
- We paid 140bp for six months on a notional of $10million.
- Carry = Entry Spread x Time in Years x Notional
  = 140bp x 0.5 x $10mm
  = $70,000
- Total P&L = Mark-to-market – Carry
  = $200,000 (or 2% of notional)

Source: J.P. Morgan

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Annuity Risk in Full Running Spread trades

Annuity Risk

- We have exited our long protection position in Verizon by selling protection on the same notional.
  - We receive $60,000 every year from the difference in the two spreads.
  - The present value of these payments gives us a mark-to-market profit of $270,000
- What happens if the company defaults tomorrow?
  - All coupons would cease and we wouldn't receive any of our $60,000 payments.
  - Our positive mark-to-market of $270,000 would disappear.
  - Our position still has default risk despite us exiting the trade!
  - This is known as **annuity risk**.
- Even if the company does not default, we still have exposure to the default risk of the company. We value our 60bp annual payment using the risky annuity; the risky annuity will fall as spreads widen and default becomes more likely.
- What's the solution? Trading CDS on **Fixed Coupons + Upfronts** instead of full running spreads.

Source: J.P. Morgan

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Fixed Coupon + Upfront Trading Convention

Fixed Coupon + Upfronts

- Since 2009, nearly all CDS contracts trade with a Fixed Coupon + Upfront format rather than Full Running Spread.
- In our original Verizon trade, we bought protection at 140bp.
  - Full Running Spread format – we pay 140bp every year.
  - **Fixed Coupon format – we pay standard 100bp coupon every year.**
  - We are only paying 100bp for something worth 140bp!
  - **To compensate for this we also pay a one-off upfront amount.** This is equal to the present value of the difference between the 140bp we should be paying and the 100bp we are actually paying.
- To calculate the upfront we should pay, we need to calculate the present value of what we should be paying (140bp) and what we are actually paying (100bp). We can do this using the risky annuity we discussed in the previous section.

Upfront amount = Risky Annuity x (Quoted Spread – Coupon) x Notional

- If the quoted spread is higher than the coupon then the buyer of protection will pay the upfront. If the quoted spread is lower than the coupon then the seller of protection will pay the upfront.
- For our Verizon example, the buyer of protection will pay $180,000 (=4.5 x (140-100) x $10mm)
- Standard coupons = 100bp for IG names, 500bp for HY names.

Source: J.P. Morgan

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Trading Verizon with Fixed Coupons and Upfronts

Fixed Coupon + Upfronts

- We carry out the same Verizon trade as before, but use an upfront + fixed coupon format rather than a full running spread format this time.
- We buy 5y protection at 140bp with a fixed coupon of 100bp on notional of $10mm.
  - Upfront = 5 x (140bp – 100bp) x $10mm = $200k.
  - We pay upfront of $200k and pay coupon payments of $100k every year.
- Six months later, we sell protection at 200bp with a fixed coupon of 100bp on notional of $10mm.
  - Upfront = 4.5 x (200bp – 100bp) x $10mm = $450k.
  - We receive upfront of $450k and receive coupon payments of $100k every year.
- Mark to market = New upfront – Old upfront
  = $450,000 - $200,000
  = $250,000
- We have paid six months of carry equal to $50,000 (= 100bp x 0.5 x $10mm).
- Total P&L = Mark to market – Carry
  = $250,000 – $50,000
  = $200,000

Source: J.P. Morgan

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Annuity Risk in Fixed Coupon + Upfront Trades

Closing out Fixed Coupon trades

- After closing out trade we will:
  - Pay 100bp coupon in original contract.
  - Receive 100bp coupon in second contract.
  - Net we have no ongoing payments.
- If the company defaults we have no exposure as we are not receiving any net payments.
- **There is no annuity risk in Fixed Coupon + Upfront trades** – as long as trades use the same fixed coupon.

Source: J.P. Morgan

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Pricing CDS in Bloomberg - CDSW

90) Actions | 91) Products | 92) View | 93) Settings | Credit Default Swap Valuation

Cpty CDS CNTRP | Client | CCP OTC | Ticker / TELEF | Series | Deal#

31) Load | 32) Save | 34) Ticket | 35) Refresh | 39) Send to VCON/TR

Deal

Buy	Notional 10 MM EUR	Contract 2014	STEC
REF Entity	Telefonica SA		
Debt Type	Senior	Restructuring	MM14
REF Obligation	XS1550951211	RED Pair Code	8FGCBAAF8
Trade Date	07/08/19	Trd Sprd (bp)	62.0000
1st Accr Start	06/20/19	Backstop Date	05/09/19
1st Coupon	09/20/19	Coupon (bp)	100.000
Pen Coupon	03/20/24	Day Cnt ACT/360	Freq Q
Maturity	5Y 06/20/24	Pay AI True	Date Gen I
Use curve recovery rate	True	Business Days	5D
Recovery Rate	0.40	Bus Day Adj 1	Amrt N

Calculator — ISDA Standard Upfront Model (I)*

Cash Settled On	07/11/19	Valuation Date	07/08/19
Cash Calculated On	07/11/19		
EDD	No		
Price	101.87665523	Spread DV01	5,014.56
Principal	-187,665	IR DV01	48.60
Accrued (19 Days)	-5,278	Rec Risk (1%)	80.70
Cash Amount	-192,943	Def Exposure	6,187,666

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

Market

Curve Date 07/08/19

Swap Curve 261 Mid

5) View EUR ISDA Standard Curve.

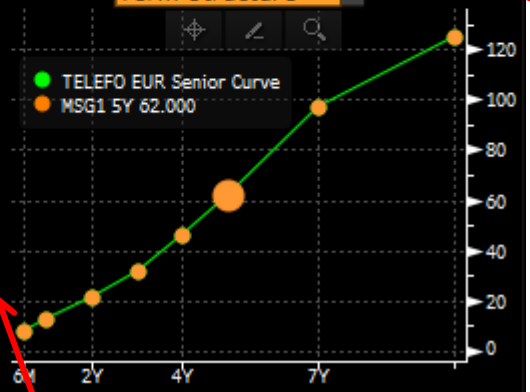
CDS Curve C MSG1 Ask

6) <TELEFO EUR Senior Curve> | CDSD »

Recovery Rate 0.40

Term	Pts Upf	Spread	Prob
06/20/24	-1.87665523	62.0000	0.0506

View Term Structure



Fixed Coupon

Quoted Spread

Upfront (%)

Upfront (€)

Dirty Upfront (€)

Spread DV01 (€)

Source: Bloomberg

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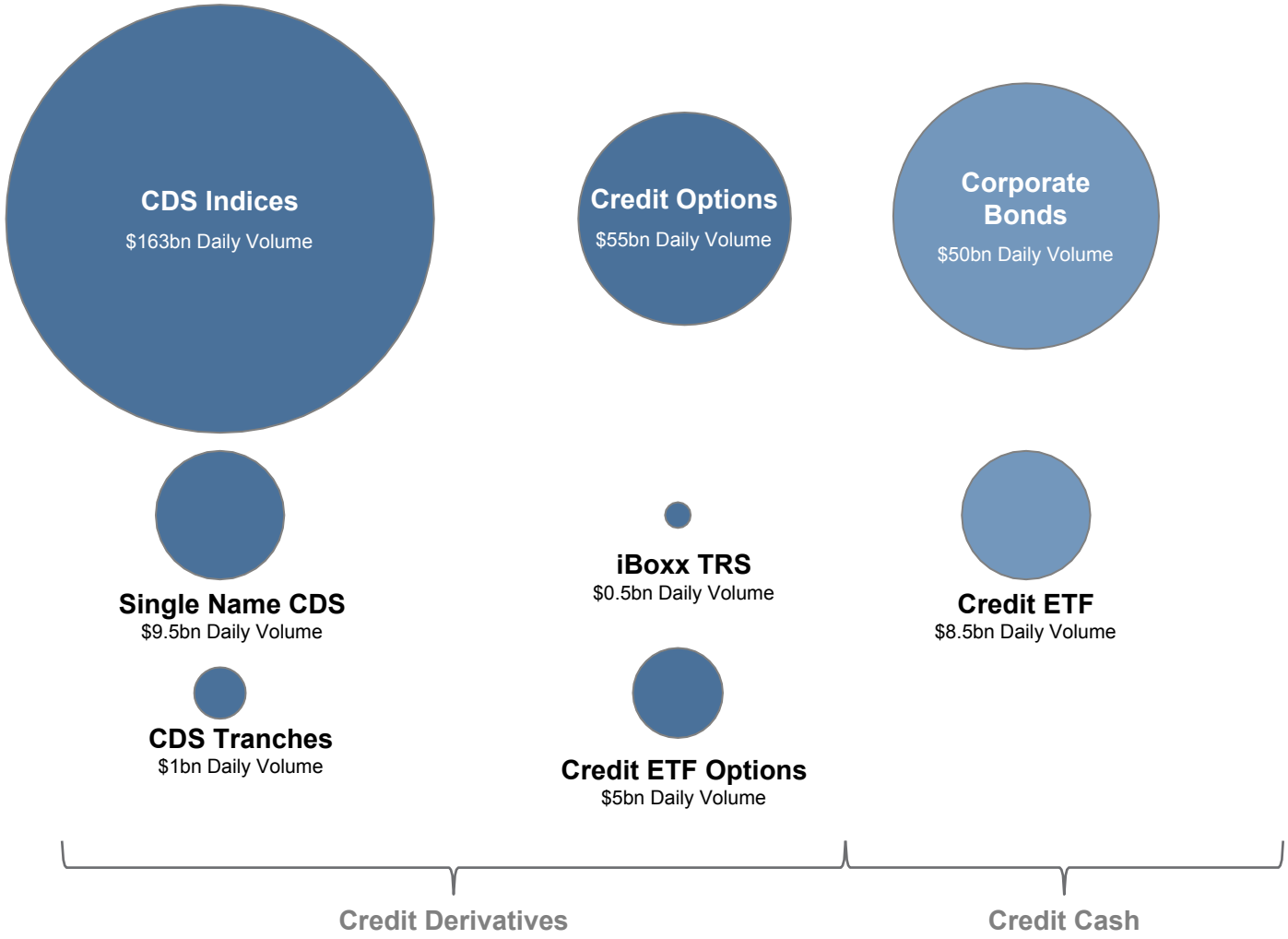
Market Overview

Average Daily Volumes across Credit Markets



Source: J.P. Morgan, DTCC

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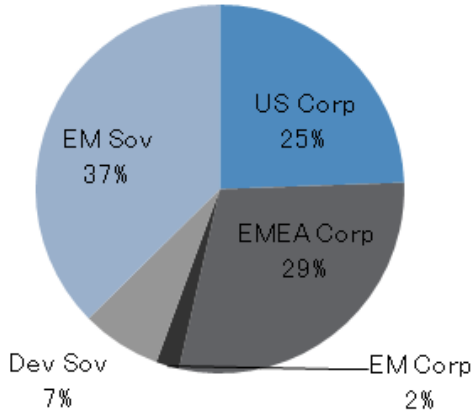
Market Structure

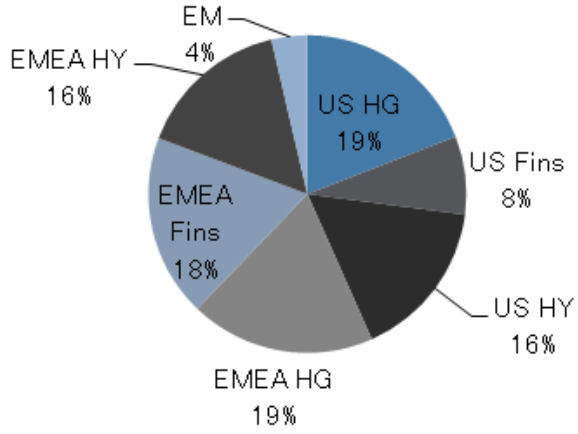
Overview

- ~$2.5tn annual volume globally
  - ~$1.5tn Corps, ~$1tn Sovs
- ~32% HY, 26% Fins, 38% IG Corps
- 50% - 90% client trades (varies by regime)
  - Typical Bid/Offer: 5% of spread
- Typical size = €1-5mm (HY), €5-25mm (IG)

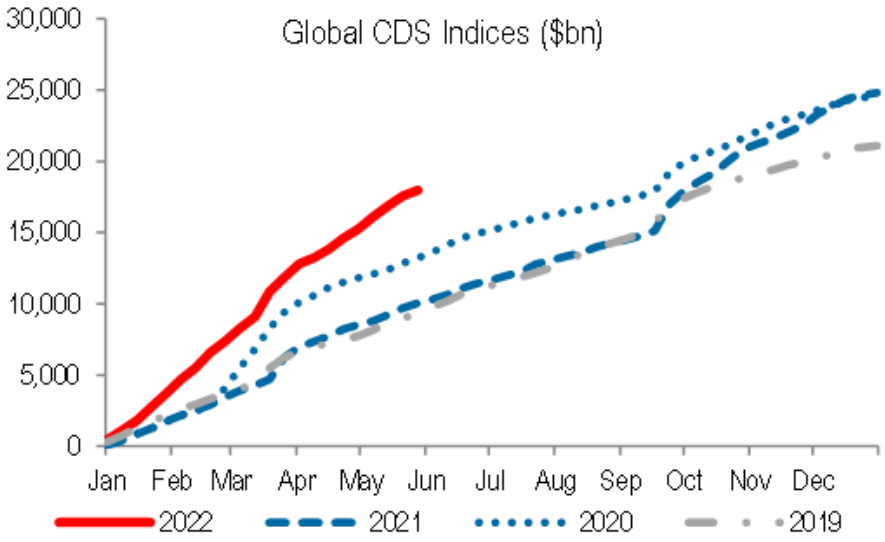
Global Split of CDS Notionals



Split of Corporate Volumes by IG / HY / Fins



$2.5 tn / year traded annually



Source: J.P. Morgan, DTCC

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Market Participants

Typical Buyers of Protection

- **Loan Desks**
  - Hedge banks' exposure to loan counterparties
  - Less active than in past but still high market share
- **CVA Desk**
  - Hedging counterparty exposure on the back of Financings (e.g. XCCY Swaps, Rates Swaps etc).
  - Can be triggered by other market variables (FX / Rates)
- **Hedge Funds**
  - Opportunistically when stories develop
  - Used to be a larger part of the market
- **Basis Package Traders**
  - Active when basis is negative

Typical Sellers of Protection

- **Real Money**
  - Typically large, sophisticated accounts that come to CDS market for risk-taking,
  - Not usually forced sellers on downgrades
  - Increasing market share with positive bond-basis
- **CLN Desks**
  - Disseminate CLNs to end-clients
  - Like national champions
- **Correlation Desks**
  - Hedging CSOs

Neutral Flows

- **Arb Lists**: Depends on sign of index basis, can be meaningful flow for illiquid names.
- **Dealers**

Source: J.P. Morgan

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Further Online Resources

CDS resources

- ihsmarkit.com/ & www.markit.com/Documentation/
  - CDS data
  - Index data and rules
- www.dtcc.com/repository-otc-data/
  - Data on Credit Derivatives outstanding volumes & trading activity
- cdsdeterminationscommittees.org
  - Requests to the Determinations Committee, decisions and information about credit events
- www.creditfixings.com
  - Information about all the CDS auctions that have been held by ISDA

Source: J.P. Morgan

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CDS INDICES

Global Credit Derivative and Index Research

Dmytro Shelukhin [AC]

Credit Index & Derivative Strategy

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J.P. Morgan Securities Plc

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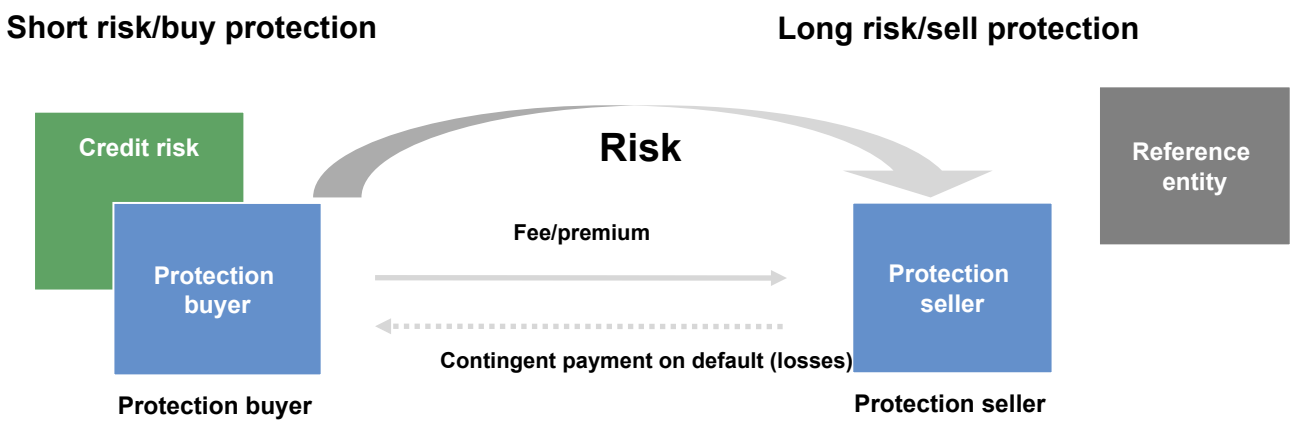
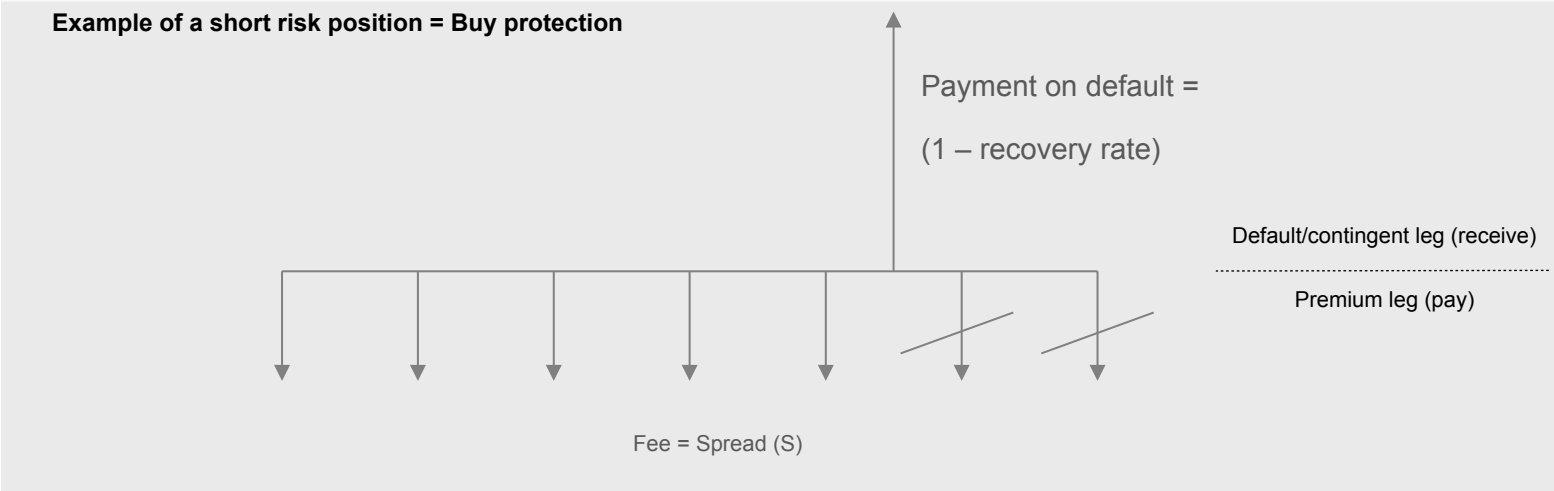
Credit Default Swap Mechanics Recap



In cash flow terms



Source: J.P. Morgan

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Credit Default Swap Mechanics Recap

Credit Default Swaps

- There are two counterparties in a CDS contract: Buyer of protection
  Seller of protection
- The protection buyer pays the protection seller regular fees – known as the **spread**.
- In return, if the underlying company defaults, the protection seller will make a payment to the protection buyer equal to (1 – Bond Recovery) x Notional.
- Each CDS contract specifies (among other things):
  - The underlying company that insurance is being bought on – the “reference entity”
  - The seniority level (usually senior unsecured debt)
  - The maturity of the contract – norm is 5 years
  - Notional of the trade
  - The contract spread/price – this quoted figure determines “fixed coupon + upfront” cash flows
  - How we define a default

Source: J.P. Morgan

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What is a CDS Index?

- CDS indices allow investors to take diversified long or short exposure to a credit market.
- CDS indices are the most liquid instruments in the credit markets .
- CDS indices are effectively **baskets of single name CDS**.
  - e.g. iTraxx Main is a basket of 125 single name CDS contracts in European Investment Grade.
- CDS 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).
- CDS indices **trade as a single contract**, meaning that you can get diversified macro exposure to credit without trading a large number of single name CDS contracts.
- (Most) CDS indices are usually **equally weighted**: e.g. each name in iTraxx Main makes up 1/125th or 0.8% of the index notional.
- The cost of buying protection on iTraxx Main will be very similar to the cost of buying protection on all 125 single names, but there can be some differences.
- Why trade CDS indices instead of just the single names?
  - Much easier to trade one single contract than 125 different single name contracts.
  - Lower bid-offer for index.
  - Higher volumes.
  - Quick way to gain exposure to the credit risk of a region or sector.

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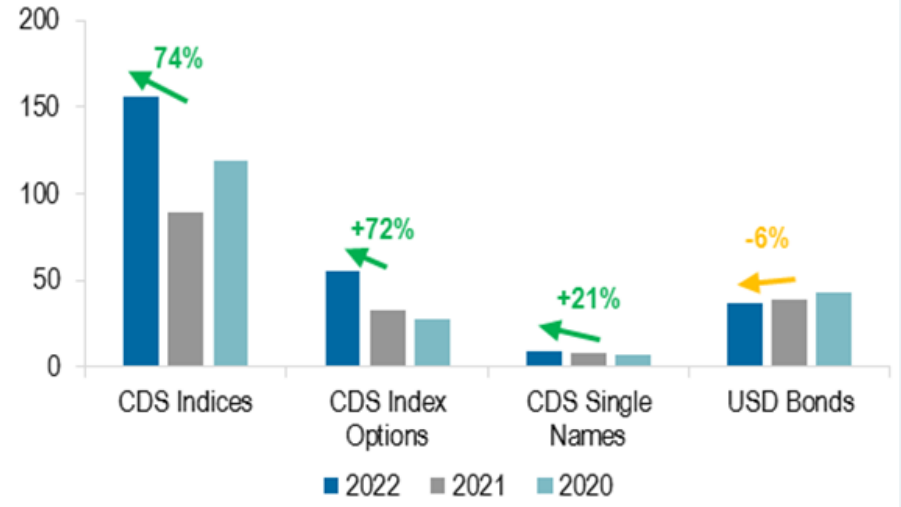
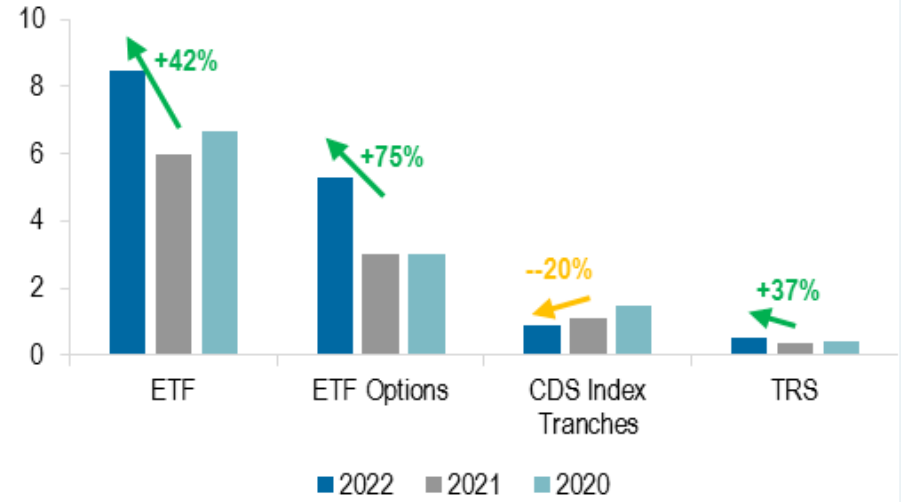
CDS Indices are the most liquid instruments in the credit market

Average Daily Volumes in ’22 vs ’20-21 ($bn)





- Headline index numbers continue to grow strongly in 2022 even outstripping the volumes seen in 2020
- Single name CDS volumes grow but at a much slower pace as macro hedge demand remains very strong.

- Credit ETF Markets continue to attract more demand with rapid growth in ETF Options in particular.
- Tranche markets remain more subdued while TRS reverses the move lower in volumes in 2021.

Source: J.P. Morgan, DTCC

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Global CDS Indices

European CDS Indices: iTraxx Europe Family
iTraxx Main (Investment Grade) + Senior / Sub Financials sub-indices + Main ESG
iTraxx Crossover (High Yield)

US CDS Indices: CDX Family
CDX.NA.IG (+ BBB sub-index)
CDX.NA.HY (+ BB, B, Ex-BB sub-indices)
CDX Financials (upcoming)

Asia-Pacific CDS Indices:
iTraxx Japan
iTraxx Asia Ex-Japan IG
iTraxx Australia

Emerging Markets CDS
CDX.EM (+ IG & HY sub-indices)

Legacy indices:

- iTraxx SovX Western Europe
- iTraxx SovX CEEMEA
- iTraxx Corp CEEMEA
- iTraxx HIVOL
- iTraxx Asia Ex-Japan HY
- CDX Latin America

Source: J.P. Morgan

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

97) Settings ▾ — CDS Index Monitor

Markit Indices	Spread	Chg	Spread	Basis	Roll	Historical Data (Spread, 3 Months) Low	Range (Avg / Now)	High	Avg	+/-	3M Chg
1) Americas											
10) CDX Investment Grade	64.56	-0.50		-23.6	2.4	64.6		82.2	71.7	-7.1	-13.5
11) CDX High Yield	105.80*	+0.08		3.0	0.2	98.6		105.8	102.2	+3.6	+7.7
12) MCDX	166.53	-0.30			16.4	166.5		257.8	205.3	-38.7	-91.3
13) CDX Latin America	156.09	-0.07				153.5		169.8	161.7	-5.6	+2.6
2) EMEA											
20) iTraxx Europe	53.08	-1.26		-2.6	3.4	52.6		72.4	61.4	-8.4	-19.9
21) iTraxx Crossover	313.57	-10.57		-21.4	16.9	313.6		415.2	364.5	-50.9	-119.7
22) iTraxx Sr Financial	59.39	-1.90		1.2	8.6	59.4		86.1	72.1	-12.7	-27.2
23) iTraxx Sub Financial	126.59	-2.47		7.9	15.3	126.6		184.6	153.4	-26.8	-59.6
24) iTraxx SOVX CEEMEA											
3) Asia											
30) iTraxx Japan	60.71	-0.09		5.3	9.9	57.4		69.7	60.9	-0.2	-9.4
31) iTraxx Asia Ex Japan IG	65.03	+1.06		-5.0		64.5		101.9	80.6	-15.6	-37.7
32) iTraxx Australia	63.28	-1.25		-10.9		63.3		102.4	85.1	-21.8	-39.7
Emerging Markets											
40) CDX Emerging Market	96.78*	+0.06		-1.5	-0.9	91.7		96.8	95.5	+1.3	+5.4

Source: Bloomberg

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European CDS Indices

iTraxx Main	iTraxx Crossover

■ 125 European **Investment Grade** Companies
■ Equally weighted
  ■ Sector constraints (sector buckets filled based on constituent liquidity within min-max sector limits):
  ■ 24-36 Autos & Industrials
  ■ 20-30 Consumers
  ■ 16-24 Energy
  ■ 16-24 TMT
  ■ 30 Financials
■ Constituents must be rated higher than BBB-/Baa3 Neg Outlook – stricter definition vs cash indices.
■ Composition is based on the names with the highest trading volumes.
■ 1y, 3y, 5y, 7y and 10y points are traded (5y most liquid).
■ Quoted on spread.
■ Trades on upfront + **100bp** fixed coupon.
■ €50bn daily volume across entire market.
	■ 75 European **High Yield** Companies
	■ Equally weighted
	■ Financials not allowed (except Specialty Finance)
	■ No sector constrains
	■ Constituents must be rated BBB-/Baa3 Neg Outlook or below.
	■ Unrated issuers are allowed as long as CDS spread is greater than 1.5 x spread of Main Non-Financials.
	■ No distressed – 500bp upfront < 50pt
	■ New CDS contracts can be introduced via Suppl. List.
	■ Composition is based on the names with the highest trading volumes.
	  ■ 3y, 5y, 7y and 10y points are traded (5y most liquid).
	■ Quoted on spread.
	■ Trades on upfront + **500bp** fixed coupon.
	■ €15bn daily volume across entire market.

Source: J.P. Morgan

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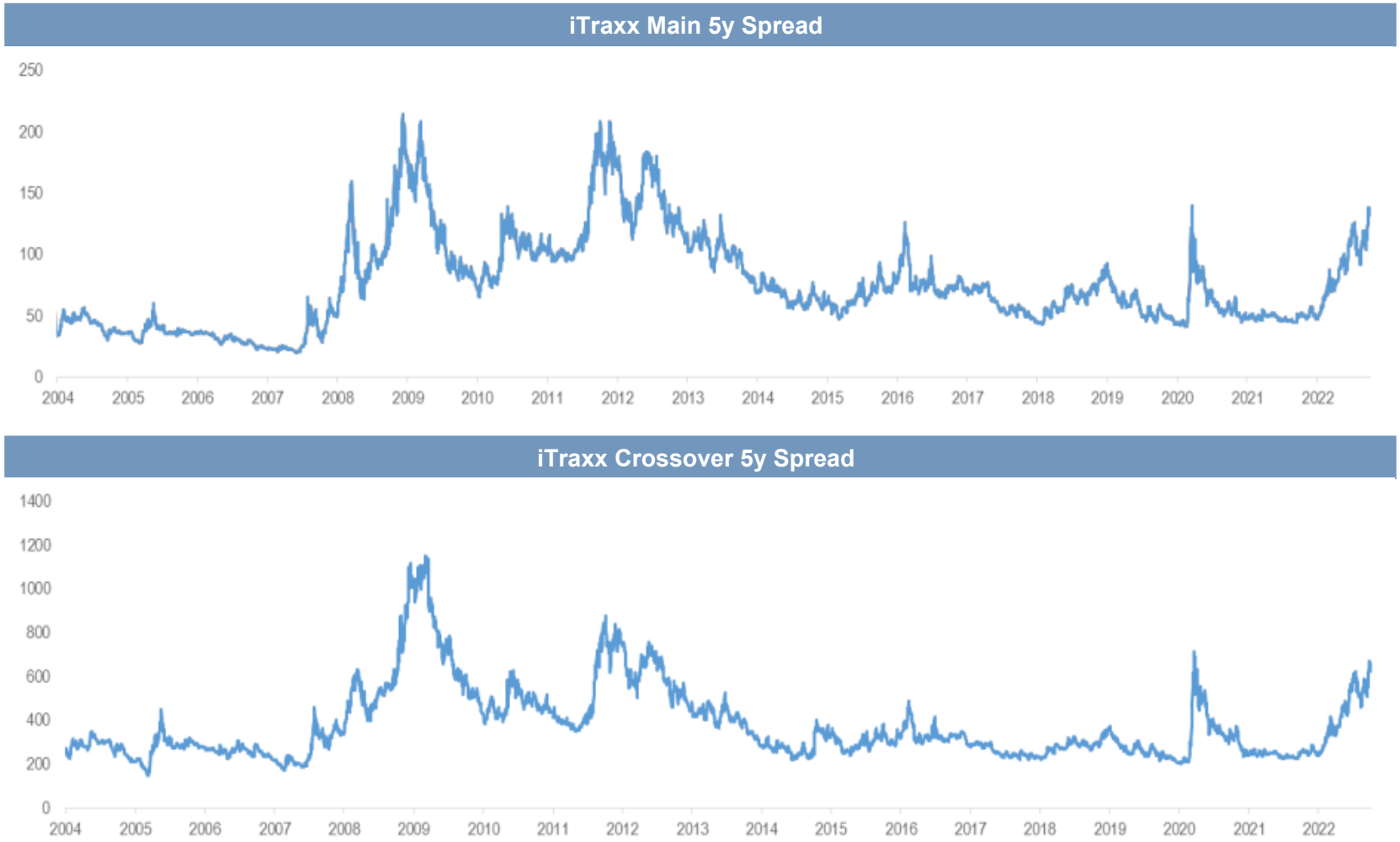
iTraxx Main and Crossover Historical Spreads



Source: J.P. Morgan

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European CDS Indices - continued

iTraxx Senior Financials	iTraxx Subordinated Financials
■ 30 European Banks and Insurance Companies	■ 30 European Banks and Insurance Companies
■ Equally weighted	■ Equally weighted
■ Subset of 30 Financials that appear in iTraxx Main.	■ Same 30 names as Senior Financials.
■ **References the Senior Unsecured debt** (SLAC where available otherwise Senior Preferred/HoldCo).	■ **References the Tier 2 debt.**
■ 5y and 10y points are traded (5y most liquid).	■ 5y and 10y points are traded (5y most liquid).
■ Quoted on spread.	■ Quoted on spread.
■ Trades on upfront + 100bp fixed coupon.	■ Trades on upfront + 100bp fixed coupon.
■ €4.5bn daily volume across entire market.	■ €700m daily volume across entire market.

Source: J.P. Morgan

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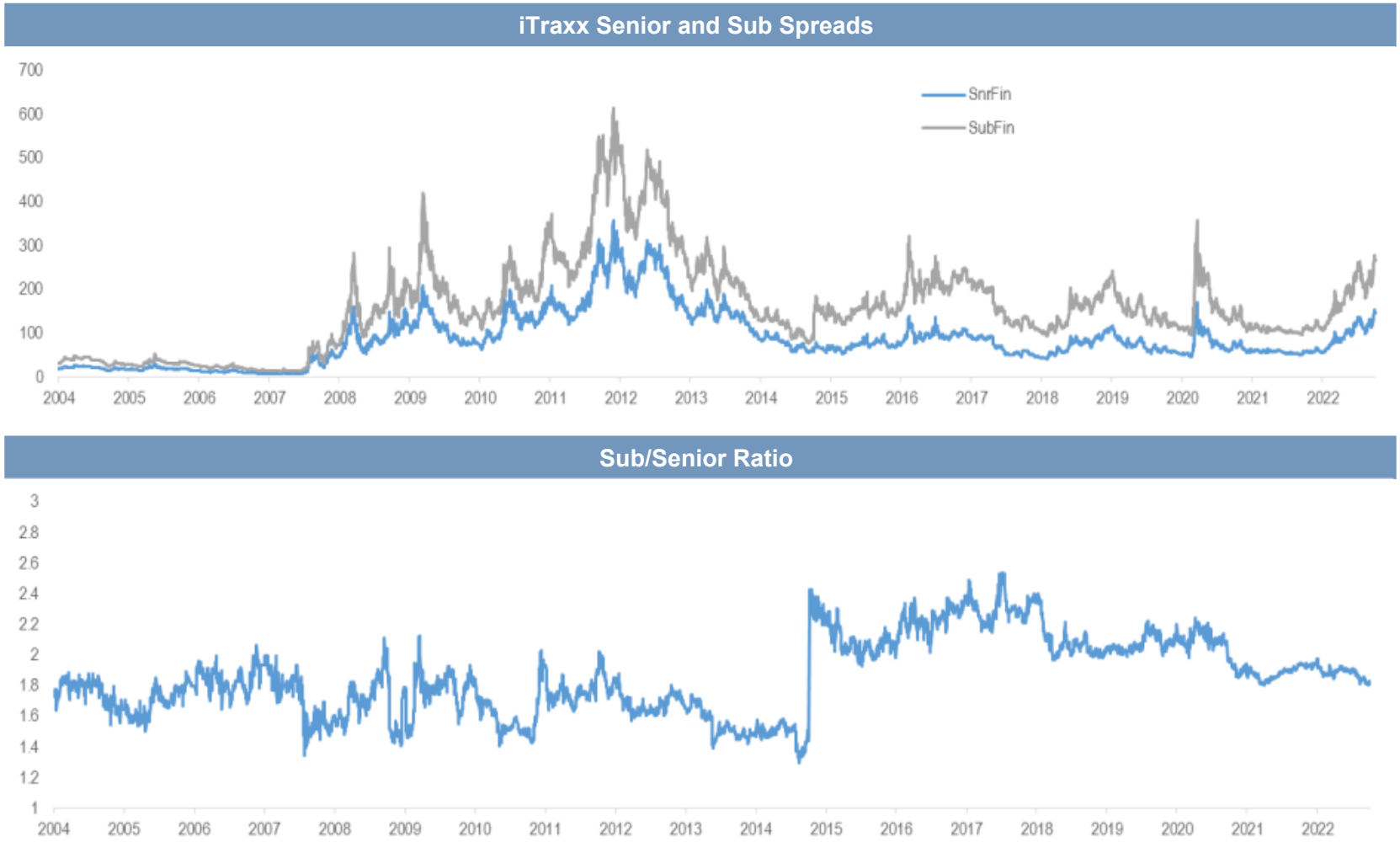
iTraxx Senior and Subordinated Financials Spreads



Source: J.P. Morgan

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US CDS Indices

CDX Investment Grade	CDX High Yield
■ 125 North American Investment Grade Companies	■ 100 North American High Yield Companies
■ Equally weighted	■ Equally weighted
■ Very few banks and financials	■ Financials not allowed
■ Constituents must be rated higher than BBB-/Baa3 Neg Outlook.	■ Constituents must be rated BBB-/Baa3 Neg Outlook or below.
■ Composition is based on the names with the highest trading volumes.	■ Composition is based on the names with the highest trading volumes.
■ 1y, 3y, 5y, 7y and 10y points are traded (5y most liquid).	■ Additional mechanism to include new names to increase weightings of unrepresented sectors
■ Quoted on spread.	■ 3y, 5y, 7y and 10y points are traded (5y most liquid).

■ Trades on upfront + 100bp fixed coupon.	■ **Quoted on price**
	  ■ Price = $100 – Upfront
	  ■ e.g. price of $99 means buyer pays 1% upfront.

■ $60bn daily volume across entire market.	■ Trades on upfront + 500bp fixed coupon.
	■ $16bn daily volume across entire market.

Source: J.P. Morgan

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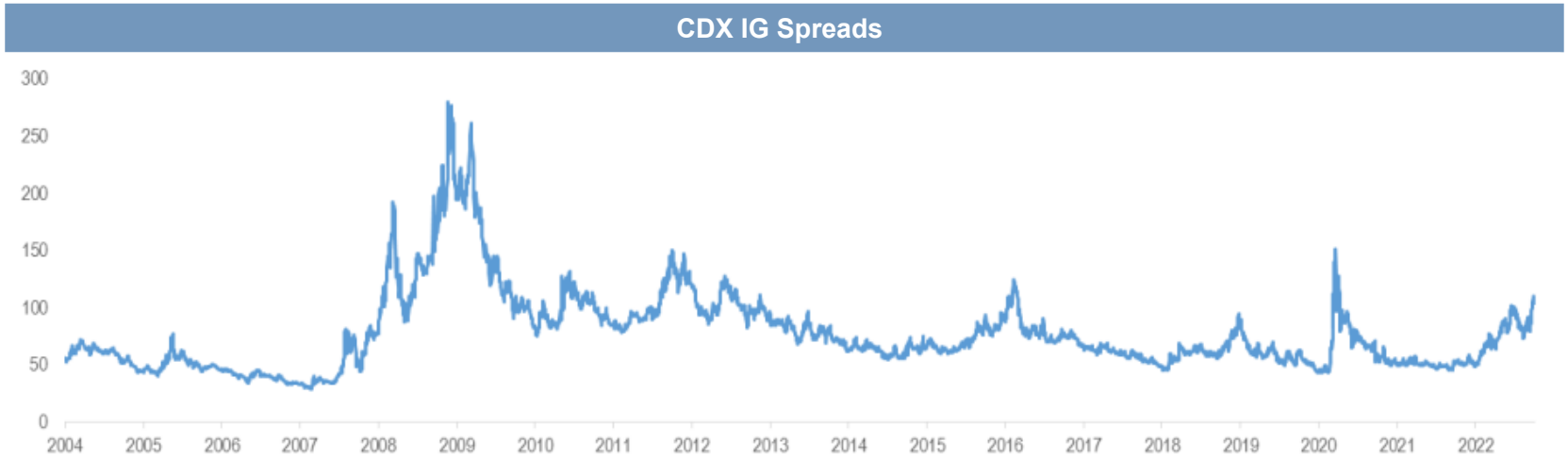
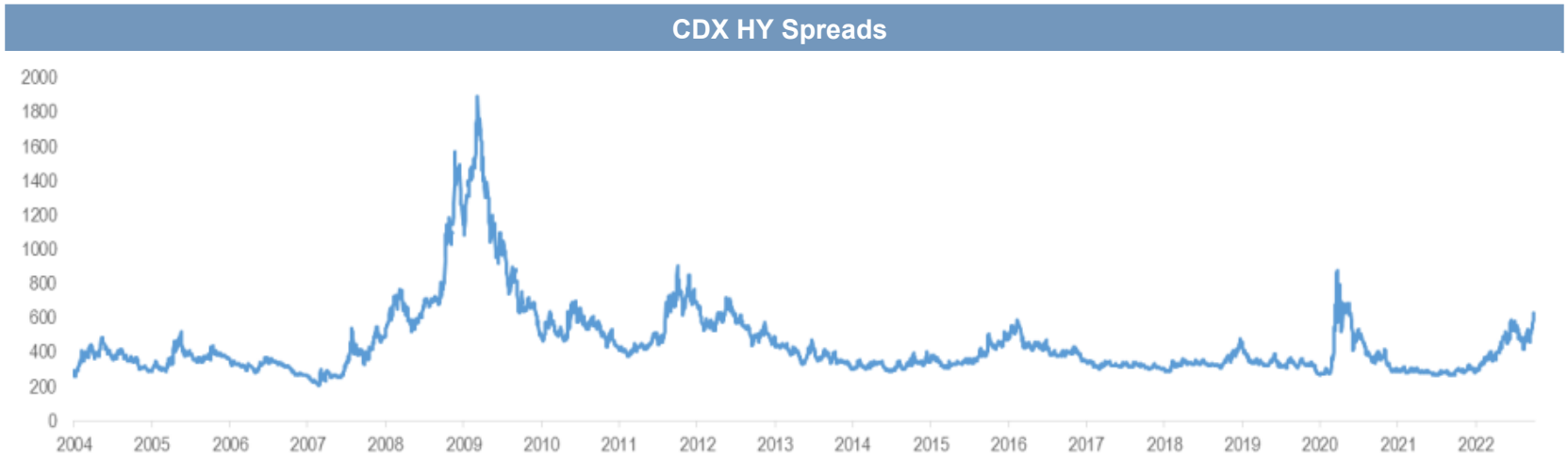
CDX IG and CDX HY Spreads





Source: J.P. Morgan

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CDS Index Mechanics

CDS Index Mechanics

- CDS indices are quoted and traded in the same way as single name CDS.
- Quoted on spread basis, which is used to calculate traded upfront amount.
- Example:
  - We buy iTraxx Main protection on €100million for a 5y maturity.
  - Quoted spread is 75bp
  - We will pay the fixed coupon of 100bp.
  - Due to the difference in the quoted spread and fixed coupon we will also receive an upfront amount, equal to 1.125 % of notional.
- CDX HY is quoted on price, not spread. Price = 100 – Upfront.
- Convention: “buy the index” = buy prot. in iTraxx and CDX.IG but sell prot. in CDX.HY.
- The ISDA Standard Model is used to calculate upfronts from spreads.
- You can download the ISDA Standard Model at www.cdsmodel.com (also implemented in CDSW menu on BBG).

Source: J.P. Morgan

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CDSW calculator on BBG is the industry standard for mark-to-market calculations

90) Actions | 91) Products | 92) View | 93) Settings | Credit Default Swap Valuation

Cpty CDS CNTRP + Client CCP OTC Ticker / CDX34 Series Deal#

31) Load | 32) Save | 34) Ticket | 35) Refresh | 38) Trade Activity | 39) Send to VCON/TR

Deal

Buy Protection	Notional 10 MM USD	Factor	0.930000000
CDS Index	MARKIT CDX.NA.HY.34 06/25*		
Bberg Index ID	SP9U3AC6	RED Pair Code	2I65BRYD6
Trade Date	09/01/20		
Trade Price	105.727	Coupon (bp)	500.000
1st Accr Start	03/20/20	Payment Freq	Quarterly
1st Coupon	06/22/20	Day Count	ACT/360
Pen. Coupon	03/20/25	Bus Day Adj	Following
Maturity Date	06/20/25	Pay AI	True
Crv Rec	True	Business Days	5D
Rec Rate	0.3000	Date Gen	B

Calculator — ISDA Standard Upfront Model (I)*

Cash Settled On	09/04/20	Valuation Date	09/01/20
Cash Calculated On	09/04/20		
Price	105.72700000	Spread DV01	4,147.59
Principal	-532,611	IR DV01	127.69
Accrued (72 Days)	-93,000	Rec Risk (1%)	924.57
Cash Amount	-625,611	Def Exposure	7,042,611

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

Market

Curve Date 09/01/20

Swap Curve 260 Mid

5) View USD ISDA Standard Curve.

CDS Curve C CBIL Bid

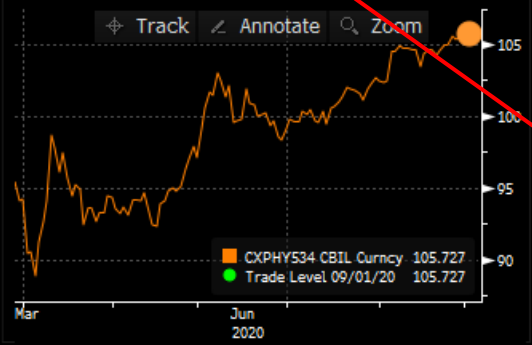
6) <SP9U3AC6 Curve> | CDSD »

Recovery Rate 0.30

Term	Pts Upf	Spread	Prob
06/20/25	-5.72700000	365.9121	0.2247

View Historical Data YTD

Track | Annotate | Zoom



Maturity

Mark-to-market (clean)

Index notional factor

Std Coupon

Recovery rate

Current CDS spread

Upfront

Source: Bloomberg

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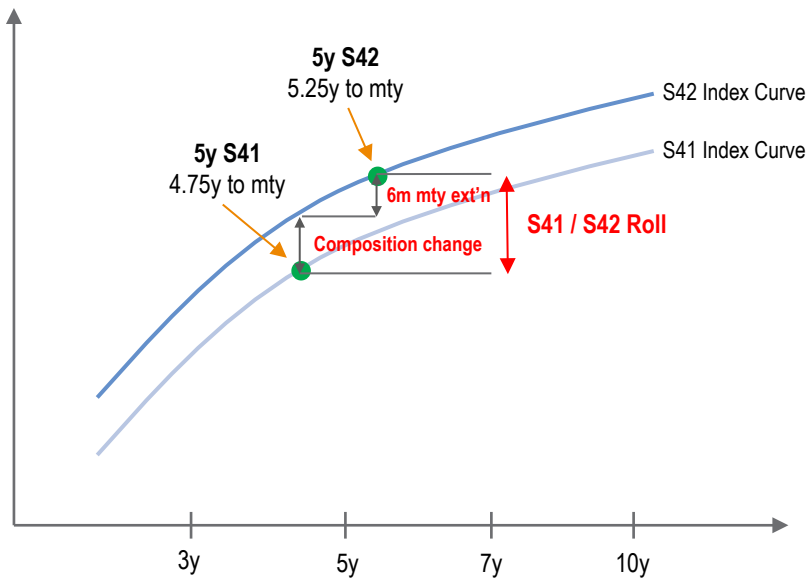
CDS Index Series and Rolls

- CDS indices trade in what are known as "Series".
- A new series is launched every six months on **20th March** and **20th September** – this is known as the "index roll".
- The new series of each index has a **new composition** and **extra six months of maturity**.
- The latest series is known as the **"on-the-run"** index.
- In September 2024 the "on-the-run" series was Series 42 for iTraxx indices and Series 43 for CDX indices.
- For example, on 20 September 2024 we rolled from iTraxx S41 to iTraxx S42.
  - iTraxx S42 indices will have an updated composition reflecting liquidity and rating changes over the previous six months.
  - iTraxx S42 5y maturity is 20-Dec-2029, 6 months longer than the iTraxx S41 5y maturity of 20-Jun-2029.
- Old indices become "off-the-run". They still trade but become less liquid over time.



Source: J.P. Morgan

Rolls in Practice

- Switching a position from an old series to a new series is known as "rolling" the position.
- For example, an investor who had bought protection on iTraxx Main S41 could roll to the new series by selling back protection on Main S41 and buying protection on Main S42.
- Rolls are optional; if investors do nothing then they continue to hold the position in the old series.
- The majority of positions held by investors are rolled to the new series in order to maintain liquidity.

iTraxx Main S42 / S41 Composition Changes

	ENTRANTS (in S42, but not in S41)			LEAVERS (in S41, but not in S42)		
	Name	5y CDS	Reason	Name	5y CDS	Reason
1	ALSTOM	96	Upgrade	GSK PLC	28	Liquidity
2	Rolls-Royce PLC	79	Upgrade	DSM B.V.	20	Liquidity
3	Cellnex Telecom SA	81	Upgrade	United Utilities PLC	58	Liquidity

Source: J.P. Morgan

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JPMorgan screen for CDS Indices: {JPTE <GO>}

Page 1/1 JP Morgan Electronic Execution

Index OTR | Index 1-OFF | Roll & Switches | Index Curves | Main OFFTR | Xover OFFTR | Fins OFFTR | IG OFFTR

J.P.Morgan — Index OTR — MSG Contributor 10:30:33 — Zoom 100%

JP Morgan Electronic Execution -> Credit Derivatives -> CDS Global Index -> CDS Index -> Index OTR

CDS Indices are owned by Markit — GLOBAL CDS INDICES

ITRAXX 5YR	BID	ASK	CHANGE	BID SIZE(MM)	ASK SIZE(MM)	Time
1) EUROPE S42	59.1200	59.4800	-0.20	155	155	10:30
2) XOVER S42	315.2000	316.8000	0.25	37	37	10:29
3) FIN SNR S42	67.0500	67.5500	-0.20	105	105	10:29
4) FIN SUB S42	120.0000	122.0000	-0.50	53	53	10:29

Index OTR | Index 1-OFF | Roll & Switches | Index Curves | Main OFFTR | Xover OFFTR | Fins OFFTR | IG OFFTR

J.P.Morgan — Roll & Switches — MSG Contributor 10:31:15 — Zoom 100%

JP Morgan Electronic Execution -> Credit Derivatives -> CDS Global Index -> CDS Index -> Roll & Switches

CDS Indices are owned by Markit — GLOBAL CDS INDICES

ITRAXX 5YR	BID	ASK	CHANGE	BID SIZE(MM)	ASK SIZE(MM)	Time
1) MKIT Roll ITRX EUR S41/42 5YR	6.4450	6.4550	-0.02	500	500	10:31
2) MKIT Roll ITRX XOV S41/42 5YR	36.2600	36.4400	0.05	125	125	10:31
3) MKIT Roll ITRX SNF S41/42 5YR	6.3700	6.4100	-0.01	250	250	10:30
4) MKIT Roll ITRX SBF S41/42 5YR	11.8750	12.1250	0.00	50	50	10:30

Index OTR | Index 1-OFF | Roll & Switches | Index Curves | Main OFFTR | Xover OFFTR | Fins OFFTR | IG OFFTR

J.P.Morgan — Main OFFTR — MSG Contributor 10:32:11 — Zoom 100%

JP Morgan Electronic Execution -> Credit Derivatives -> CDS Global Index -> CDS Index -> Main OFFTR

CDS Indices are owned by Markit — GLOBAL CDS INDICES

ITRAXX 5YR	BID	ASK	CHANGE	BID SIZE(MM)	ASK SIZE(MM)	Time
ITRAXX 5Y ROLLS						
1) EUROPE S40/42	9.3400	9.5200	0.03	75	75	10:31
2) EUROPE S39/42	15.3800	15.6600	0.05	75	75	10:31
3) EUROPE S38/42	21.3500	21.7300	0.05	75	75	10:31
4) EUROPE S37/42	27.5700	28.1500	0.09	75	75	10:31
5) EUROPE S36/42	33.1600	34.4400	-0.15	75	75	10:31
6) EUROPE S35/42	38.3900	41.1700	-0.36	75	75	10:31
7) EUROPE S34/42	45.4900	49.4700	0.25	50	50	10:31
8) EUROPE S33/42			0.24			10/02
ITRAXX 5Y OUTRIGHT						
9) EUROPE S40	49.5050	50.2350	-0.23	75	75	10:31
10) EUROPE S39	43.4200	44.1400	-0.25	75	75	10:31
11) EUROPE S38	37.3700	38.1500	-0.25	75	75	10:31
12) EUROPE S37	30.9500	31.9300	-0.29	75	75	10:31
13) EUROPE S36	24.6600	26.3400	-0.06	75	75	10:31
14) EUROPE S35	17.9300	21.1100	0.16	75	75	10:31
15) EUROPE S34	9.6300	14.0100	-0.45	50	50	10:31
16) EUROPE S33			-0.04			10/02

Source: J.P. Morgan, Bloomberg

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CDS Indices and Credit Events

Credit Events

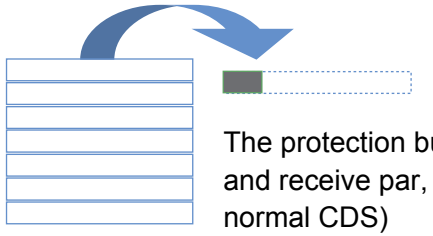
- CDS indices handle credit events in the exact same way that a basket of single name CDS.
- When a credit event happens, the single name splits out from the CDS index and is settled separately like a normal single name CDS contract.
- The defaulted single name is not replaced; the CDS index continues to trade on a reduced notional.
- Coupons will be paid on the full notional until the credit event date, and on the reduced notional afterwards.
- Example:
  - We buy €125mm of iTraxx Main protection (125 names), equivalent to €1mm protection on each of the single names.
  - There is a credit event on one name with a 40% recovery.
  - We receive €600k = €1mm x (1-40%) from the single name portion of the index.
  - The index will continue to trade and will now be known as "Version 2" of the Series. After the auction, the new reduced notional of the index will be €124mm.

Source: J.P. Morgan

1 Credit Event on one of the names

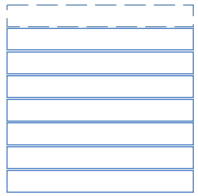
The protection buyer and the protection seller can trigger the contract

2 The triggered name is stripped out of the contract and settled separately like a normal single name CDS.



The protection buyer will deliver the bonds and receive par, or cash settle (like a normal CDS)

3 The contract remains live on a reduced notional



Premium is paid or received on a reduced notional going forward

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Example Relative Value Trades with CDS Indices

- CDS 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
- **Index basis trades:** trading the index vs. the underlying single-name CDS in the portfolio
  - Example: Buy Main Series 40 5y protection and sell 5y protection on the individual 125 single-name CDS in the Series 40 basket
- **Curve trades:** relative value across the tenors of a single index
  - Example: 5s10s CDX.IG on-the-run duration-weighted steepener
- **Roll trades:** relative value across different Series of the same index family
  - Example: Sell protection Xover Series 38 5y and buy protection Xover Series 40 5y
- **Cross-index trades:** relative value between different markets (within credit or cross-asset)
  - Main vs Xover (IG vs HY)
  - Main vs SnrFins (Corps vs Fins)
  - Main vs CDX.IG (Europe vs US)
  - Main vs SX5E (Credit vs Equity)
  - Main vs VSTOXX (Credit vs Equity Vol)
  - Main vs IEAC (Synthetics vs Cash)

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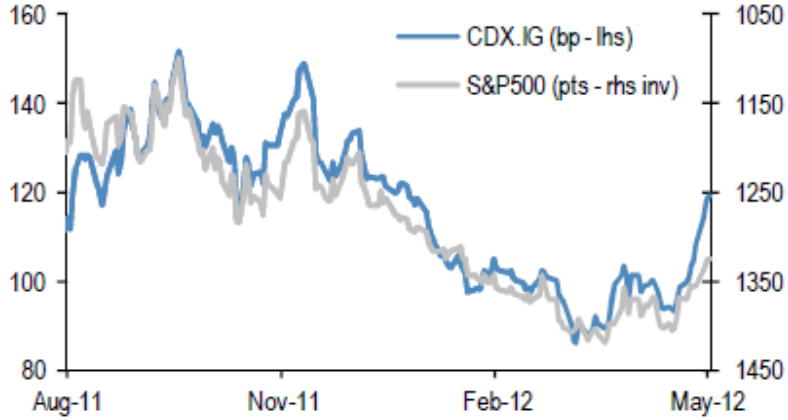
Cross-Index Trades

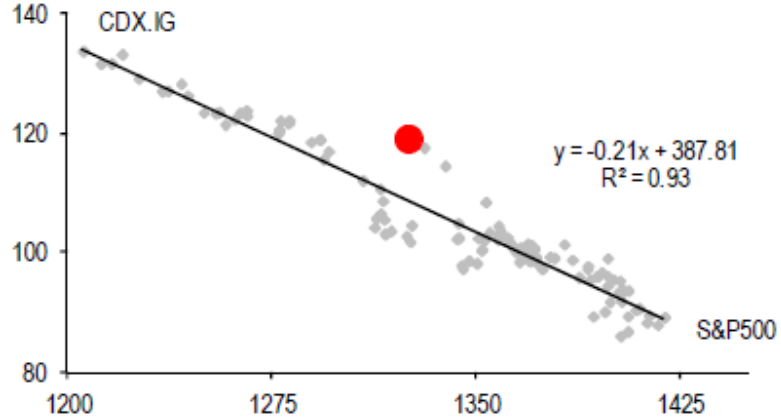
Credit vs Equity

- 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
  - 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



Source: J.P. Morgan

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Curve Trades: CDX.IG 5s10s duration-neutral steepener

CDX.IG looks too flat vs. trend and vs. fair value 5s10s duration-weighted steepener has attractive time value

Trade

- Sell CDX.IG 5y protection and buy CDX.IG 10y protection, duration neutral (i.e., sized 1.8:1).

Rationale

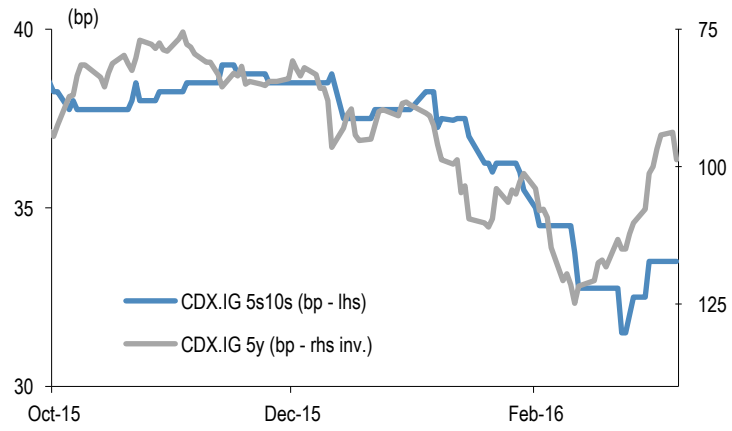
- CDX.IG 5s10s curve appears too flat relative to its recent trend vs. the index and also relative to its underlying single-name CDS. The curve is about 3bp too flat in either perspective.
- By comparison, iTraxx Main is 36bp steep with the 5y index at 92bp.
- The duration-weighted steepener is also carry positive ($460k per year, if the trade is sized $180mn:$100mn) and slide positive (about $400k per year, assuming the curve is unchanged from its current levels). So the total time value looks quite attractive at about $860k per year.
- The main risk to the trade is that the markets sell off and the curve flattens as a consequence. The current beta is for the 5s10s curve to flatten by about 1.3bp when the 5y index widens by 10bp. However, the trade would still break even if the curve steepens by about 5bp over the next year as the carry is quite positive.
- There is also a risk in case of near-term default as the trade net sells $80mn of protection. However, we believe this is unlikely, even though some names in the index are trading quite wide.

Trade Details

B/S	Instrument	Expiry	Notional	Entry Level	1y carry	1y slide
Sell Prot	CDX.IG 5y	Dec 2020	180,000,000	99bp	1,782,000	-450,769
Buy Prot	CDX.IG 10y	Dec 2025	100,000,000	132bp	-1,320,000	859,054
Net				33bp	462,000	408,284

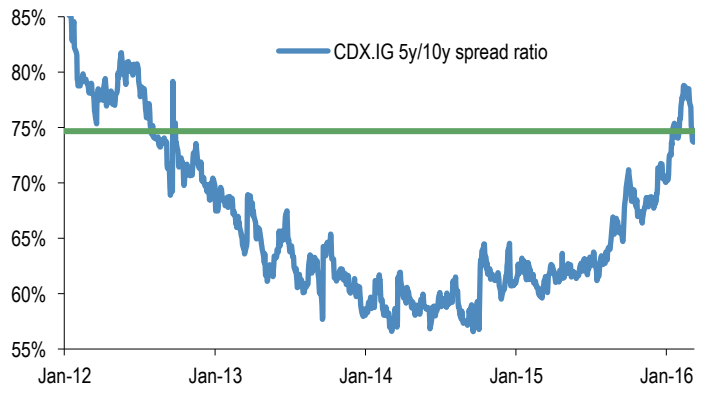
Source: J.P. Morgan. Pricing as of EOD 8 Mar 16.

CDX.IG 5s10s curve has not steepened by much in the recent rally, and the curve looks too flat vs. the index



Source: J.P. Morgan

In relative terms, the 5y level has not been this close to the 10y level in almost four years



Source: J.P. Morgan

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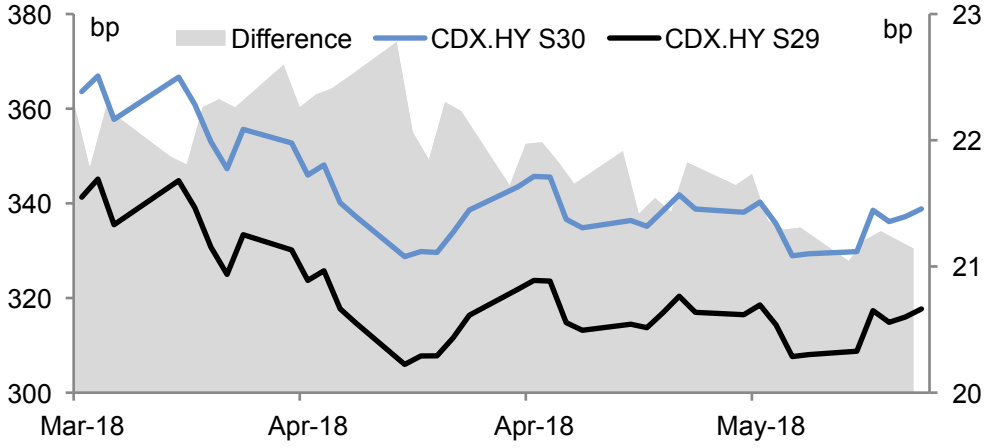
Roll Trades

- 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 S30 3y vs. S26 5y, which both mature in Jun 2021
  - Same tenor
    - Example: CDX.HY S30 5y vs. S29 5y
    - Note that this is also a curve trade

Difference between CDX.HY S29 and S30

Series 29	5Y CDS (bp)	Series 30	5Y CDS (bp)
MBIA Insurance	763	MBIA Inc	642
Level 3 Comm	188	Sabre Holdings Corp	257
CalAtlantic Group,	127	United Continental	241
Realogy Group	306	The ServiceMaster	337
M.D.C. Holdings	154	Continental Resources	88
Average	308	**Average**	313

CDX.HY S30 has traded wider to S29 since inception



Source: J.P. Morgan, as of May 2018

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Traded vs. Theoretical Spread: Basis to Theoretical

- The traded spread of a CDS index is driven by demand and supply.
- We can also calculate a theoretical spread for the index using the spreads of the underlying single names.
- These spreads will often not be the same – the difference is known as the basis-to-theoretical (aka index skew).
- **Basis to theoretical = Traded Index spread – Theoretical Spread**
- Why does the basis exist?
  - Both idiosyncratic factors and macro factors can be the driving force in market moves.
  - In environments where macro factors are more important, investors are more likely to express views using the index than single names. The index is likely to go wider first during sell-offs (causing the basis-to-theoretical to become more positive) and go tighter first during rallies (basis becomes more negative).
  - In idiosyncratic default risk-led environments single-name hedging drives markets. In this case single name CDS moves wider first during sell-offs (basis becomes less positive / more negative).
- If the basis gets too large, investors will look to arbitrage the difference.

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Trading the Basis

Basis to theoretical

- The index and underlying single names hold exactly the same default risk.
- If the basis-to-theoretical is very positive or negative, investors will look to arbitrage the difference by trading both the index and all the underlying single names.
- Example:
  - iTraxx Main is trading at a spread of 100bp and the underlying single names give a theoretical spread of 90bp.
  - Basis to theoretical = +10bp.
  - We sell protection on iTraxx Main at 100bp and buy protection on all 125 single names.
- To make a trade worthwhile the basis needs to be large enough to offset the cost of the bid-offer on the index and single names.
- These trades are known as *basis-to-theoretical trades* or *arb lists*.
- Arb lists in general are difficult to execute, given the problems associated with trying to line up a large number of single name trades simultaneously.

Source: J.P. Morgan

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Calculating the Theoretical Index Spread

Theoretical Spread

- We can calculate a theoretical index spread using single name trading levels.
- As a starting point, the upfront of the index should be equal to the sum of the upfronts of all the single names, adjusted for their weighting within the index.

$$U_I = \sum_{i=1}^{N} \omega_i U_i$$

U_I = Index Upfront

U_i = Single Name Upfront
ω_i = Weighting of name in index
N = Number of names in index

- If the index is equally weighted (as most are), then ω_i = 1/N. We can also express the upfronts in terms of risky annuities, spreads and coupons.

$$RA_I(S_I - C) = \frac{1}{N}\sum_{i=1}^{N} RA_i(S_i - C)$$

S_I = Index Spread

S_i = Single Name Spread
RA_I = Index Risky Annuity
RA_i = Single Name Risky Annuity
C = Fixed Coupon

- We can rewrite the index risky annuity RA_I as the sum of the individual single name risky annuities $RA_I = \frac{1}{N}\sum_{i=1}^{N} RA_i$
- This gives us:

$$\frac{S_I}{N}\sum_{i=1}^{N} RA_i - \frac{C}{N}\sum_{i=1}^{N} RA_i = \frac{1}{N}\sum_{i=1}^{N} RA_i S_i - \frac{C}{N}\sum_{i=1}^{N} RA_i$$

- The coupons cancel out and we can then express S_I as $S_I = \frac{\sum_{i=1}^{N} RA_i S_i}{\sum_{i=1}^{N} RA_i}$
- **Wider names have lower risky annuities and therefore a lower weighting** – they are more likely to default so we expect to pay the spread for a shorter amount of time.
- The lower weighting of wider spreads means that the Theoretical Spread is lower than a simple average of the single name spreads.

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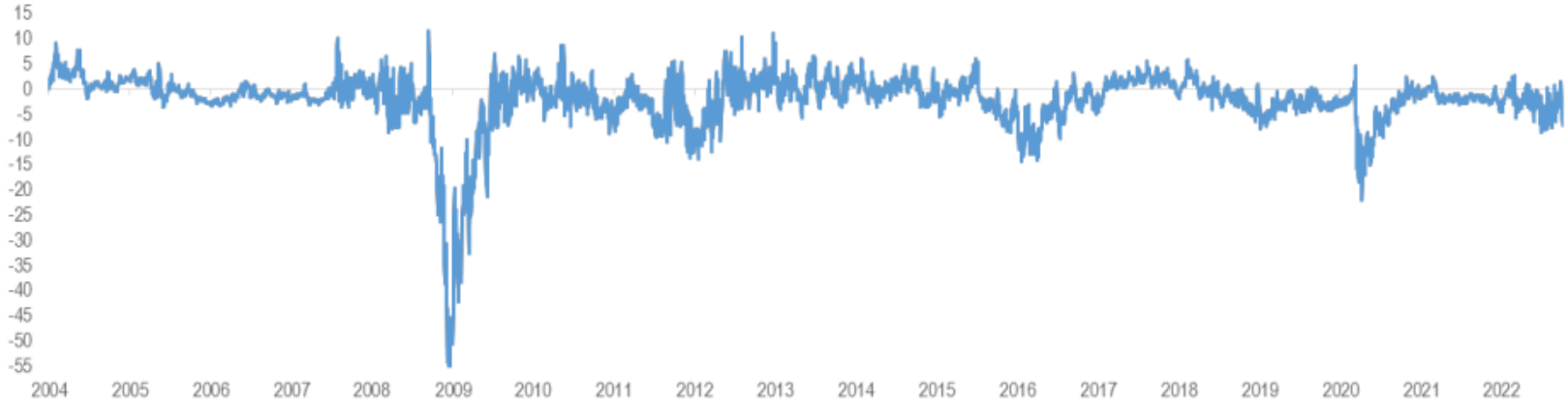
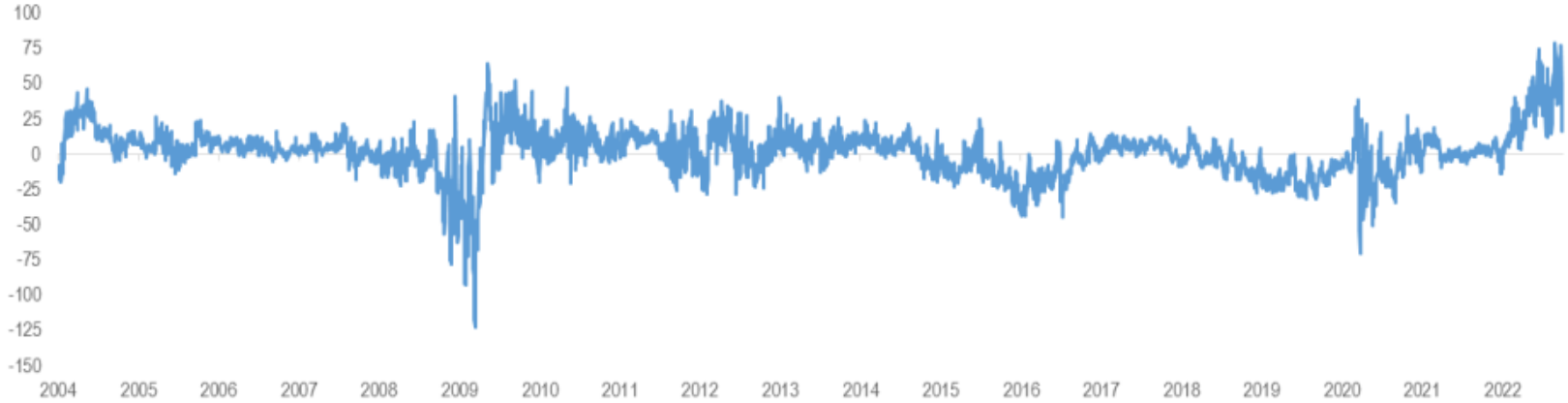
Historical Basis-to-Theoretical

iTraxx Main Basis-to-Theo (bps)



iTraxx Crossover Basis-to-Theo (bps)



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Appendix: Additional Material

- Credit Derivatives Handbook, 2006, J.P. Morgan
- Global CDS Indices, 2024, J.P. Morgan
- CDS Indices Primer, 2023, S&P Global
- iTraxx Europe and iTraxx Crossover Index Rules, 2024, S&P Global
- CDX.IG and CDX.HY Index Rules, 2022, S&P Global

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