GLOBAL VOLATILITY SUMMIT

SEPTEMBER 2015 NEWSLETTER

Dear Investor,

The Global Volatility Summit ("GVS") brings together volatility and tail hedge managers, institutional investors, thought-provoking speakers, and other industry experts to discuss the volatility markets and the roles volatility strategies can play in institutional investment portfolios. The GVS aims to keep investors updated on the volatility markets throughout the year, and educated on innovations within the space.

Morgan Stanley has provided the latest piece in the GVS newsletter series.

Cheers,

Global Volatility Summit

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2016 EVENT

The 2016 Global Volatility Summit is confirmed for March 16, 2015 at Pier Sixty in New York City. Registration will open in the late fall, and we will continue to update the website with the agenda and speakers as they develop. Stay tuned!!

2015 EVENT RECAP

The 2015 event took place on March 11th at Chelsea Piers and was attended by some of the world's largest pensions, endowments, foundations, sovereign wealth funds and banks, and sponsored by hedge fund manager participants, global banks and exchanges. Innovation and technology were the key themes of the event with a focus on how technology and science augment the way we live, work and trade.

KEYNOTE AND GUEST SPEAKERS

Kevin Slavin, Algoworld expert from MIT gave a keynote address on how algorithms shape the world.
Brad Katsuyama, President and CEO of IEX, shared his story behind pioneering trading technologies.

MANAGER PARTICIPANTS

BlueMountain Capital
Capstone Investment Advisors
Capula Investment Management
Dominicé & Co. – Asset Management
Fortress Investment Group
Ionic Capital Management
JD Capital Management
Parallax Volatility Advisors
Pine River Capital Management
Saiers Capital

Morgan Stanley

August 2015

Credit Derivatives Strategy

Credit Options Overview

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Trades and prices outlined in this teach-in are illustrative, and not intended as recommendations

Credit Options Basics: Payers (Puts) and Receivers (Calls)

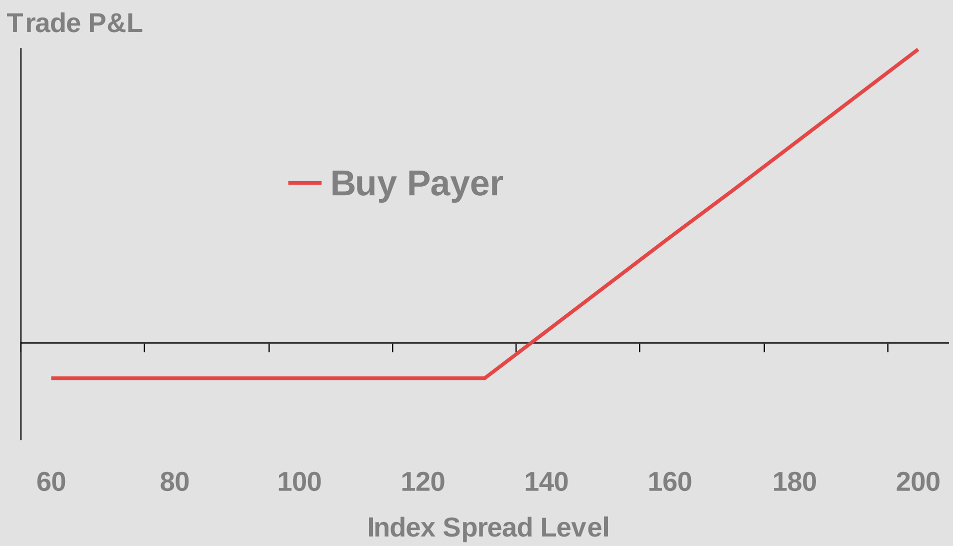
Payer Option

Option: Gives the right to buy index protection at a fixed spread on a certain date

View: Expresses **bearish** view on spreads

Equivalent to: Put option

Buy Payer (Put)



Source: Morgan Stanley Research

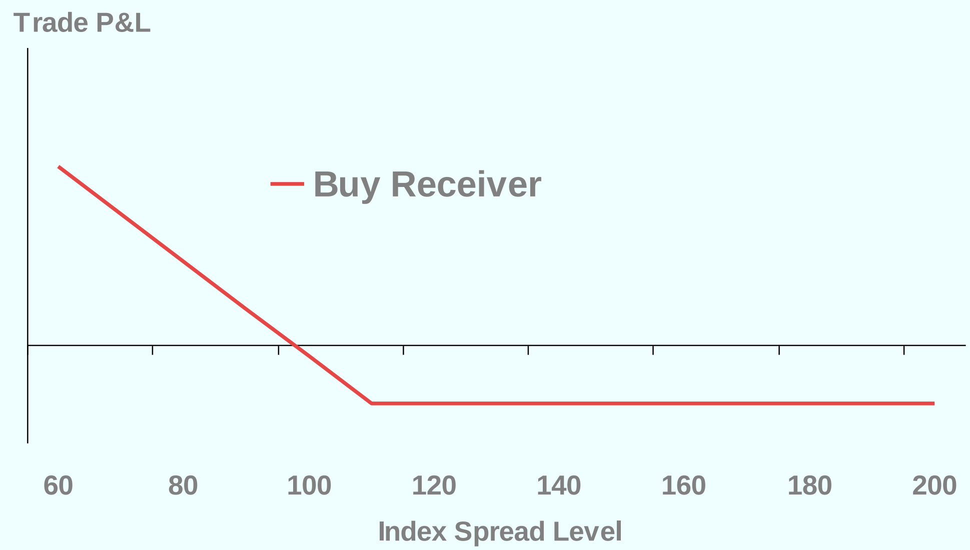
Receiver Option

Option: Gives the right to sell index protection at fixed spread on a certain date.

View: Expresses **bullish** view on spreads

Equivalent to: Call option

Buy Receiver (Call)



Source: Morgan Stanley Research

Source Morgan Stanley. As of Sep 2010
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Credit Options Basics: Trade Terminology

Notional: Fixed amount of index protection

Underlying Index: typically the 5yr on-the-run index series

Strike: Fixed spread (or price) to buy or sell index protection

Expiry: Set date to buy or sell index protection
Typically less than six months to expiry
Generally expiries which match CDS roll dates are most liquid

Premium: Quoted as upfront amount (% of notional)

Settlement: T+3 settlement

Breakeven: Spread or price at which the P&L from exercising the option is equal to the premium paid

Source Morgan Stanley. As of Sep 2010

Typical SPREAD Options Run (CDX IG)

1<GO>PURGE 2<GO>REPLY 11<GO>NEXT 12<GO>PREV 99<GO>OPTIONS
9/24 10:16:48
From: NIALL PLAYFAIR (MORGAN STANLEY & CO)
Subject: EUR MS ITX OPTIONS: Main14 OCT/DEC EXPIRY Update - REF 117
91)☆ 92) Move
+44 7

K	OCT>PAY	OCT>RCV	MidVol	DEC>PAY	DEC>RCV	MidVol
80	185-187	0-2	93.0%	201-203	4-6	65.0%
90	137-139	1-3	64.0%	161-163	11-13	66.0%
100	95-97	7-9	65.0%	127-129	23-25	67.0%
110	61-64	21-24	66.0%	98-100	41-43	68.0%
120	38-41	45-48	69.7%	76-78	65-67	70.0%
130	22-25	76-79	71.4%	59-61	94-96	71.5%
140	13-16	114-117	74.1%	46-48	127-129	73.9%
150	7-10	155-158	77.5%	35-38	161-164	74.3%
160	5-8	198-201	81.3%	29-32	199-202	76.9%
170	2-5	241-244	83.2%	23-26	237-240	78.5%
180	1-4	285-288	87.4%	18-21	276-279	79.0%
190	0-3	329-332	91.5%	14-17	316-319	80.6%

Source: Morgan Stanley

Spread Options

- Many indices (CDX IG, iTraxx Main and XOver, SovX) are quoted on a spread basis
- Strike levels on these options are quoted as a spread level
- Option prices are quoted in upfront basis points
- Ref (at top of the run) is the current spot level of the index (in this case, iTraxx Main is at 117bps)
- The volatility shown on these runs is spread volatility – a key distinction from equity or FX options
- Spread volatility has to be converted to a price volatility to make it comparable to equity volatility

Source Morgan Stanley. As of Sep 2010

Typical PRICE Options Run (CDX HY)

GRAB Index MSG
1<GO>DEL 2<GO>REPLY 3<GO>FWD 11<GO>NEXT 12<GO>PREV 99<GO>OPTIONS
9/10 7:19:53
From: JONATHAN TYRRELL (MORGAN STANLEY)
91)☆ 92) Move 94) Tags
CREDIT INDEX OPTIONS (CDX IG/HY) W:+12127611003 C:+19179719002

USER PROFILE

IB

$$ MS CDX OPTIONS: HY14 DEC Expiry UPDATE - REF $97\frac{3}{4}$ [~558bps]

		BOND PUT		BOND CALL			
K	[~Sprd]	DEC>PAY	Dlt	DEC>RCV	Dlt	MidVol	[SprdVol]
101	[474]	479-509	84%	25-55	16%	8.6%	[46.6%]
100	[500]	403-433	78%	50-80	22%	9.1%	[47.1%]
99	[526]	335-365	71%	81-111	29%	9.6%	[47.3%]
98	[553]	274-304	64%	120-150	36%	10.2%	[47.5%]
97	[581]	224-254	57%	169-199	43%	10.8%	[48.1%]
96	[609]	180-210	50%	226-256	50%	11.4%	[48.5%]
95	[637]	144-174	43%	289-319	57%	12.1%	[49.0%]
94	[666]	116-146	36%	362-392	64%	12.9%	[50.1%]
93	[695]	93-123	30%	438-468	69%	13.7%	[50.9%]
92	[725]	75-105	26%	520-550	74%	14.6%	[52.1%]

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Source: Morgan Stanley

Price Options

- CDX HY index is quoted on a price basis
- Strike levels are quoted as a price level, typically with equivalent spreads
- The index ref is shown in both price (97.75 here) and spread (~558bps)
- Option prices are quoted in upfront basis points
- The volatility quotes on these runs is generally price volatility, which is directly comparable to equity volatility

Source Morgan Stanley. As of Sep 2010
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Example: Investor buys a December payer option on iTraxx Main

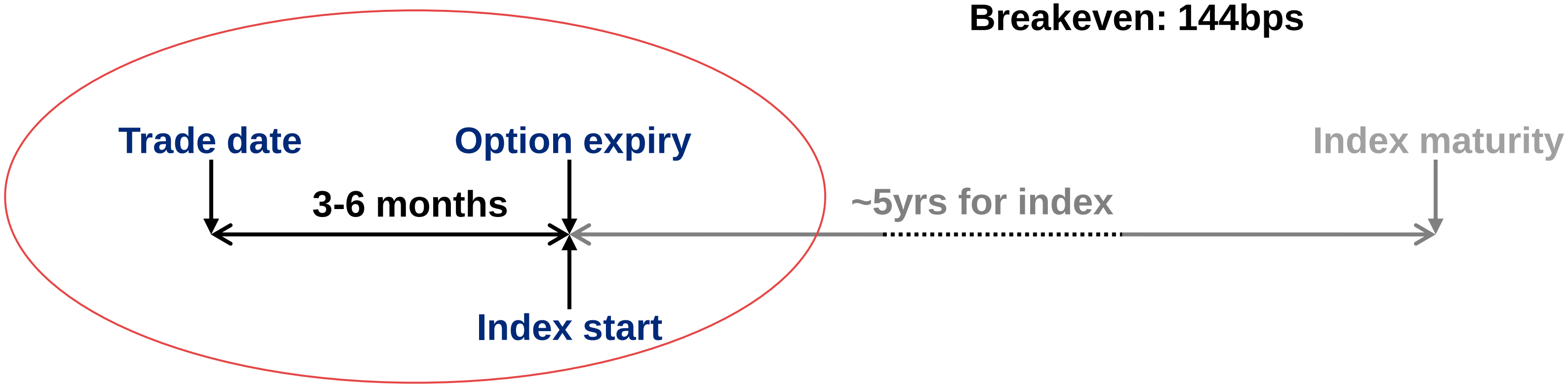
Expiry: December 15, 2010

Strike: 130bps

Notional: €10mm

Market quote: 59 / 61 for a 130 strike payer

Breakeven: 144bps



Today: Investor pays **€61,000** today (25bps * €10mm) to buy a payer

December Expiry:

1. If iTraxx Main is trading tighter than 130bps, the contract expires worthless, and nothing happens
2. If iTraxx Main is trading wider than 130bps, the investor will enter a contract to buy 5yr iTraxx Main protection from the dealer at 130bps. The investor can choose to monetize the difference between where the index is trading and the strike spread, or retain the index protection and continue to pay the index coupon.

Source Morgan Stanley. As of Sep 2010

Example: Investor buys a December payer option on CDX HY

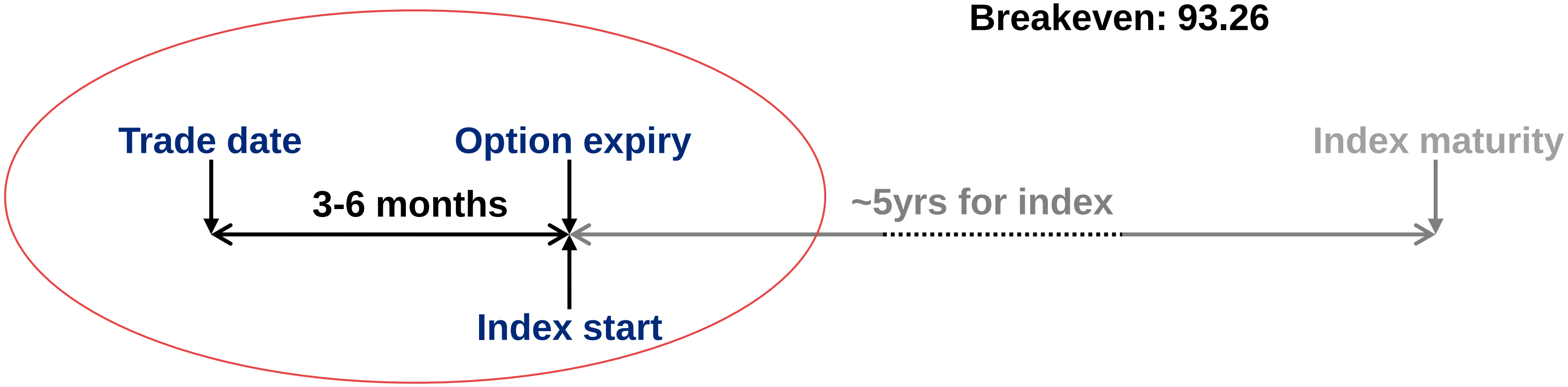
Expiry: December 15, 2010

Strike: 95

Notional: $10mm

Market quote: 144 / 174 for a 95 strike payer

Breakeven: 93.26



Today: Investor pays **$174,000** today (174bps * $10mm) to buy a payer

December Expiry:

1. If CDX HY is at a higher price than 95, the contract expires worthless, and nothing happens
2. If CDX HY is trading at a lower price than 95, the investor will enter a contract to buy 5yr CDX HY protection from the dealer at 95. The investor can choose to monetize the difference between where the index is trading and the strike price, or retain the index protection and continue to pay the index coupon.

Source Morgan Stanley. As of Sep 2010
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Credit Options Basics: Trade Expiry

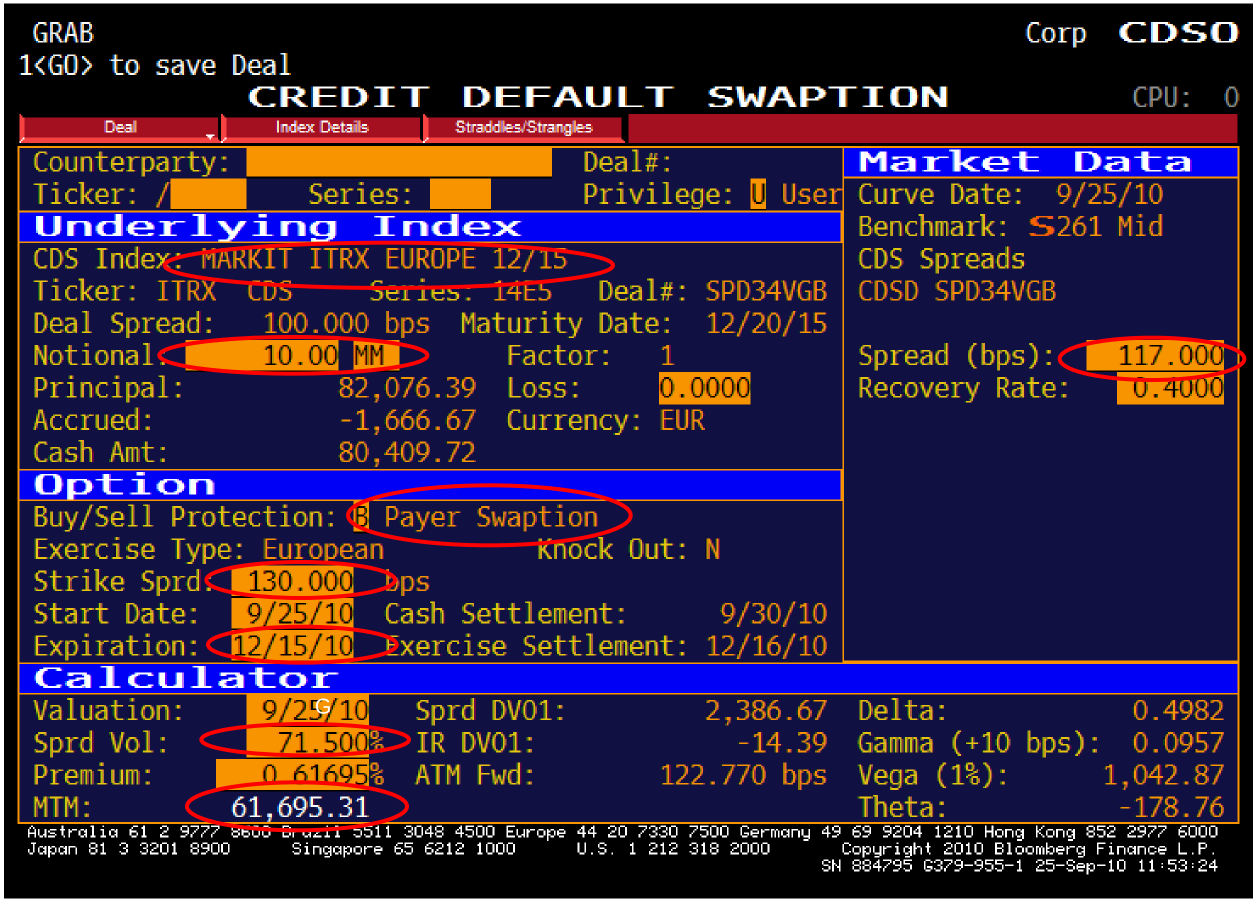
Option Exercise: Options are European, exercisable ***only*** on the option expiry date

Settlement at Expiry:

- On the expiry date, the option buyer has to explicitly state a choice to exercise the option
- Expiry date is typically the third Wednesday of the expiry month
- Exercise window is 9AM to 11AM (EST) for US and 9AM to 4PM for Europe on the expiry date
- Physical settlement is the norm for settling option trades
- If the option buyer does exercise, a new index trade is recorded and an upfront is exchanged, which is calculated assuming the trade was entered at the option strike

Source Morgan Stanley. As of Sep 2010

Pricing Tools: CDSO on Bloomberg



Inputs	Value
Underlying Index	iTraxx Main
Notional	€10mm
Option Type	Payer
Index Ref Spread	117bp
Option Strike	130bp
Expiry Date	December 15, 2010
Implied Volatility	71.5%

Outputs	Value
Option Price	0.61695% (i.e. 61bp)
Dollar Value	€61,695.31

This is a basic option model and these prices may not exactly match dealer prices due to differences in curve shape and loss expectations, etc.

Source: Morgan Stanley, Bloomberg

Source Morgan Stanley. As of Sep 2010

What Happens If There Is a Default?

If there is a credit event in the underlying index prior to expiry, nothing happens until option expiry

At expiry, the option buyer will base the exercise decision on the index spread and loss expectation from the defaulted credit

If the credit event auction settlement has not yet taken place, the option exercises normally, and the credit is settled at auction

If the credit event auction settlement has already occurred and the option exercises, the index protection is on the remaining names in the index, and the defaulted name is settled at the auction protocol price

Source Morgan Stanley. As of Sep 2010

Default: An Example

Investor buys a €100mm notional 130 strike payer option with a December expiry on September 15, 2010

Credit ABC defaults, and settles via the auction process at 40% recovery in October

At expiry, the now 124 name iTraxx Main (known as version 2) is trading at 140bps

Investor will enter into a trade to buy protection on the iTraxx Main version 2 index at 130bps and will also receive €480,000 from the protection on the defaulted credit
(100mm /125 = 800,000 per name; 800,000 * (1-40% recovery) = 480,000 loss)

To calculate new breakeven, divide the additional payout of 0.48% of the notional by the duration to get adjusted strike price
(0.48% / 4.8 = 10bps)

Thus it would still be economical to exercise the 130 strike payer if the version 2 of iTraxx Main index were trading wider than 120bps in this case

Source Morgan Stanley. As of Sep 2010
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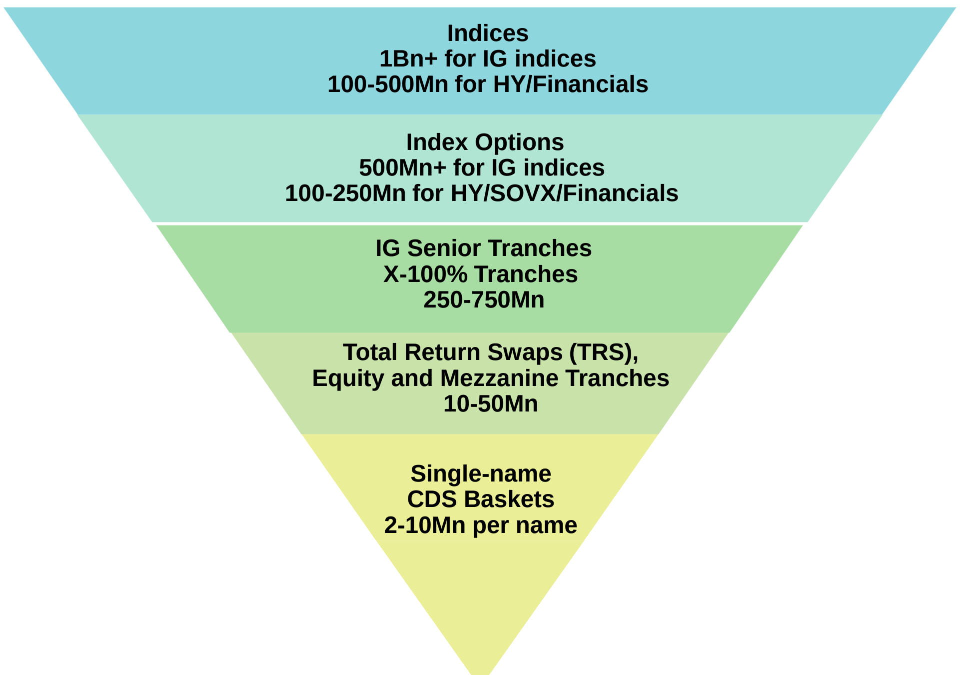
Credit Hedger's Manual

The Hedging Instruments: Single-Name CDS, Indices, Options and Tranches

Three things drive the choice of instrument:

- **Liquidity**
- **Correlation to hedged assets**
- **Cost vs. convexity**

Hedger's Liquidity Pyramid – Typical Trade Sizes



Source: Morgan Stanley Research

Credit indices: CDS indices, of which there are over 20 globally, remain the most liquid way to express a portfolio view in credit. The drawback is that the exposure is linear, meaning that the investor can lose money if the market improves, and hedging can be expensive if risk premium is already in the price.

Index options: Increasing liquidity, asymmetric payoffs and the ability to customize payouts define maximum costs at trade inception all have attracted investors to options for hedging. However, these are still very short-dated instruments, with expiries in the 3m–6m range.

Credit tranches: Tranches are designed to express a view on defaults and risk premiums separately. Their long-dated nature makes them ideal when uncertain about the time-frame of events being hedged. These are also relatively liquid, and can vary in cost depending on the strategy. Unlike options, these do have more than capped downside if the market improves.

Single-name CDS and baskets: Individual single-name CDS and baskets are less liquid than the indices, but more "customized". We like using this strategy to hedge exposure to highly specific exposures or risks.

The Credit Hedging Budget: How Much to Pay?

Having a hedging budget can be helpful when narrowing the range of hedging strategies. Deciding a hedging budget is an iterative process – a function of the portfolio being hedged and its yield, how much of a contribution is desired from the hedges and the current cost of sourcing hedges.

- We generally target payout ratios of **3.5x or higher** for hedging strategies in normal environments. Thus for every $1 spent on hedging, we would expect a payoff of about $3-6 if the hedged scenario materializes.
- During market dislocations we drop this target payout to **2.0x-2.5x.**
- Increasing the budget can facilitate the purchase of hedges with unlimited upside, whereas with a more limited budget, investors may have to settle for strategies with capped upside.
- Assuming the hedges are successful and the hedging budget generates 3.0x leverage, that can translate into 2% in hedge P&L for IG portfolio and 4.5-.7.5% for HY portfolios. We emphasize setting guidelines on constructing a hedging budget, and remaining adaptable as the market changes.

The First Step: Defining Hedge Scenarios

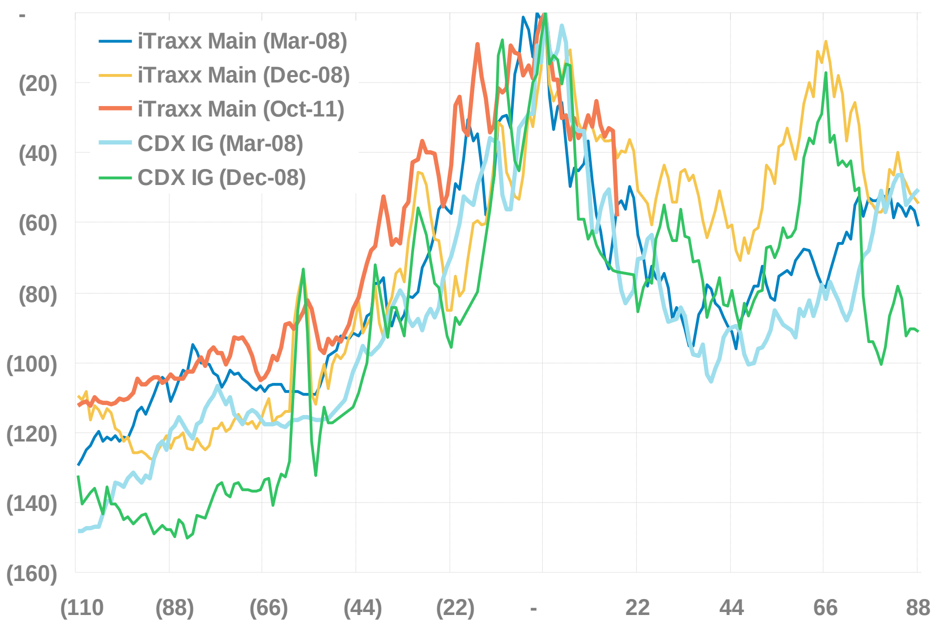
Hedging for a Large Tail Scenario

We find it useful to look at past credit selloffs to assess the extent and pace of bear market credit spread deterioration. For the moment, we ignore the basis between cash and CDS. For CDS indices specifically, we have a more limited history than the broader credit market, but our examples show roughly the same intensity and trajectory as the underlying credit market for various market declines.

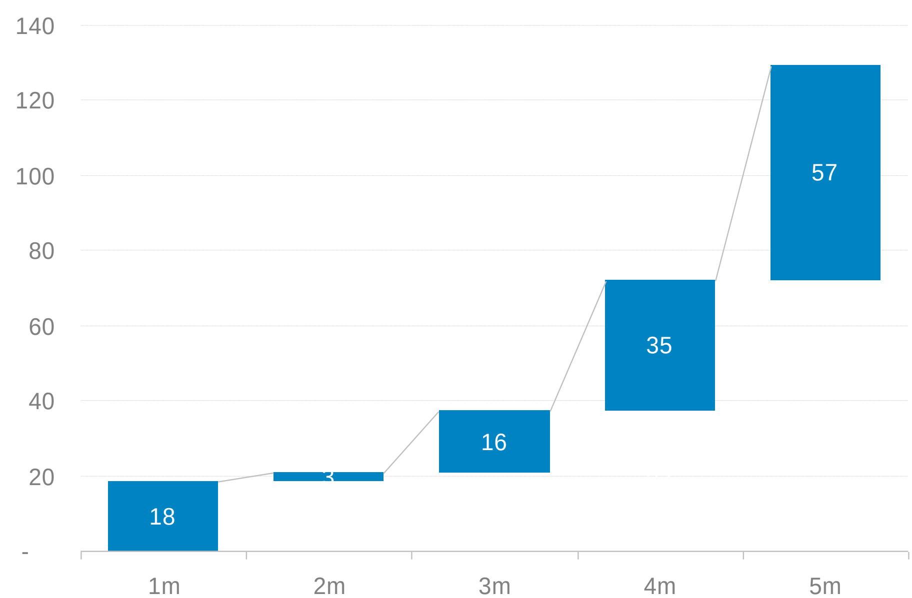
For investment grade indices a large tail scenario seems to be about 130bp of widening over five months from trough to peak, with the bulk of this in the two months preceding the peak (illustrated below).

In high yield indices, the equivalent move is around 400-600bp over a five-month period with nearly 300bp of that in the 4-8 weeks before the peak.

Historical Examples of IG Large Tail Moves



An Average Large Tail Widening in IG



Source: Bloomberg, Morgan Stanley Research

The First Step: Defining Hedge Scenarios

Hedging for a Small Tail Scenario

In investment grade indices, smaller tail scenarios are more frequent and involve 30-65bp move in a 1-3 month timeframe with the bulk of this occurring in the 4-6 weeks prior to the peak.

In high yield indices, a small tail is a move of about 150-300bp with a similar timeframe.

Small Tail Hedging: Options work better

The easiest way to hedge a small tail is by using options, which would involve buying a rather expensive ATM or close to ATM payer, coupled with a short call for a **risk reversal**, or OTM put to make a **put spread**, to cheapen the cost.

Hedging for small tail scenarios is more challenging in tranches, as spread impact on individual tranches is less clear in smaller spread widening scenarios, and the cheapest hedges can have little convexity in a moderate sell-off.

iTraxx Main Small Tail Moves

Start	End	Time Months	Spread Move
3/7/2005	5/17/2005	2.37	32
6/4/2007	7/30/2007	1.87	46
10/11/2007	11/21/2007	1.37	35
5/19/2008	7/8/2008	1.67	45
2/9/2009	3/9/2009	0.93	63
1/11/2010	2/8/2010	0.93	29
3/17/2010	6/8/2010	2.77	66
		1.70	**45**

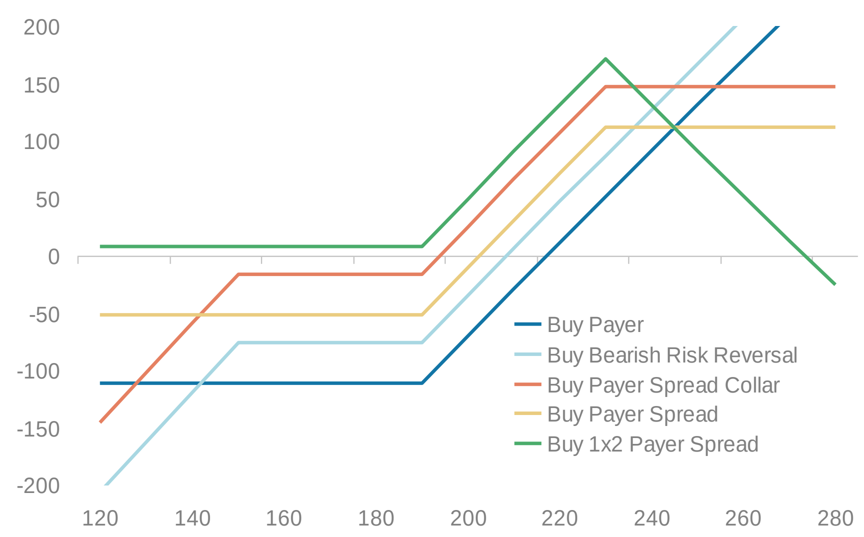
CDX IG Small Tail Moves

Start	End	Time Months	Spread Move
3/8/2005	5/17/2005	2.33	36
6/5/2007	8/3/2007	1.97	47
4/15/2010	6/9/2010	1.83	50
7/4/2011	10/3/2011	3.03	61
		2.29	**49**

Source: Bloomberg, Morgan Stanley Research

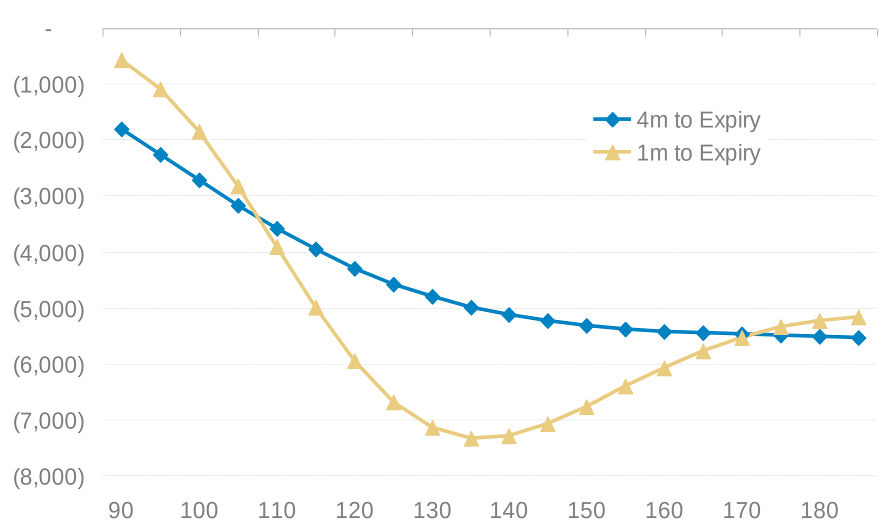
The Second Step: Choosing a Hedging Strategy

Option Hedging Strategies



Source: Morgan Stanley Research

Theta (€/day) of 4m ATM Option



Source Morgan Stanley Research

Hedging Strategies and Choice of Expiry

In options, the simplest strategy (but most expensive) is the **outright payer**, a trade with capped downside and unlimited upside if spreads widen dramatically.

One way to cheapen the cost of an outright payer is by selling a further OTM payer to make **a payer spread**. These are cheaper than payers, but don’t have the unlimited upside.

Another way to cheapen a payer is to sell an OTM receiver in a **bearish risk reversal**. These have unlimited upside when spreads widen, but also have unlimited downside in a rally.

Payer spread collars are the cheapest in a range-bound market, capping the upside if spreads widen but also taking the risk of a significant tightening of spreads.

Long vol strategies are better expressed with longer maturity options (4-6m). Short vol strategies are better expressed with option expiries less than 3m.

The Third Step: Monitoring the Hedge – A Guide to Our Methodology

To evaluate various hedging strategies across options and tranches, we evaluated each as though they were implemented on a systematic basis. We then assessed their impact across three variables as follows:

P&L Impact

This metric shows the average monthly return of systematically using the hedging strategy. A negative number indicates that the hedging overlay had a cost to the hedging investor during the period evaluated. Conversely, a positive number implies the hedging strategy added to the P&L on average over the period. This number is presented as a monthly cost (or revenue), averaged over the period.

Volatility Reduction

Here, we show the % decline in volatility of the hedged portfolio when evaluated in comparison to the unhedged portfolio. Thus if the unhedged portfolio has an annualized volatility of 10% and the hedged portfolio has an annualized volatility of 5%, that is a 50% reduction in the portfolio volatility when a hedge is implemented.

Drawdown Reduction

In this metric, we show the % change in the performance of the worst month of the hedged portfolio over the worst month of the unhedged portfolio. So for example, if the worst month for the unhedged portfolio was March 2009, in which the unhedged portfolio had a return of -3%, and the worst month for the hedged portfolio was June 2009, with -1.5% return, the drawdown reduction is 50%.

The Third Step: Monitoring the Hedge – Investment Grade Options

Systematic Hedging with Options: Payers Consistently Reduce Volatility

In our analysis, we assume the investor rolls the option hedges a month before expiry, rather than holding them to expiry. We can conclude that systematically hedging with options has been cost effective, volatility reducing, and loss protecting, across a variety of options strategies.

Cost: The cost of implementing the systematic hedge program has been less than 15bp over the course of two years

Volatility reduction: Any of the options hedging strategies helped significantly reduce the volatility of the underlying portfolio by as much as 15% to 60%

Drawdown reduction: Furthermore, the hedged portfolio experienced a similar 15% to 60% reduction in the max drawdown (difference of max monthly loss with a hedge in place vs without).

We can further parse the results and conclude that for investment grade, **"expensive" strategies such as ATM payers look better than most other strategies** in terms of both volatility reduction and drawdown reduction

iTraxx Main Jan-08 to Dec-09	P&L Impact	Volatility Reduction	Max Monthly Drawdown Reduction
ATM Payer	-15	-43%	-35%
OTM Payer	-15	-32%	-25%
OTM RR	-18	-46%	-41%
PS	-13	-15%	-6%
PSC	-16	-34%	-24%
1 X 2 payer	-8	-19%	-17%

iTraxx Main Jan-10 to Sep-11	P&L Impact	Volatility Reduction	Max Monthly Drawdown Reduction
ATM Payer	3	-66%	-65%
OTM Payer	-1	-46%	-54%
OTM RR	1	-55%	-59%
PS	-3	-17%	-15%
PSC	-2	-26%	-23%
1 X 2 payer	-1	-27%	-39%

CDX IG Options Jan-10 to Sep-11	P&L Impact	Volatility Reduction	Max Monthly Drawdown Reduction
ATM Payer	-4	-27%	-47%
OTM Payer	-6	-23%	-35%
OTM RR	-8	-21%	-33%
PS	-9	-15%	-12%
PSC	-11	-14%	-14%
1 X 2 payer	-2	-11%	-23%

Source: Morgan Stanley Research

The Third Step: Monitoring the Hedge – iTraxx Main Tranches

Systematic Hedging with CDX Tranches: Senior and X-100% Strategies Consistently Reduce Volatility

In iTraxx, like CDX IG, super senior tranches would have performed very well as part of a broader systematic hedging program prior to 2010.

In other trades however, tranche hedges in iTraxx performed rather differently from CDX IG. In CDX IG, junior tranches would have added considerable cost if not implemented on a very strategic basis, while in iTraxx, they would have still been volatility reducing and with relatively low impact on overall P&L

Interestingly, many iTraxx tranche hedges would have been volatility reducing and loss reducing throughout the more recent European stress. This would have come at varying levels of cost however.

iTraxx Tranches Jan-06 to Sep-07	P&L Impact	Volatility Reduction	Max Monthly Drawdown Reduction
6-100% (No Delta)	1	-32%	-43%
22-100% (no Delta)	0	-22%	-27%
12-22% (No Delta)	2	-59%	-79%
3-6% (Delta Scaled)	-3	-54%	-58%
6-9% (Delta Scaled)	1	-55%	-80%
9-12% (Delta Scaled)	4	-37%	-87%
12-22% (Delta Scaled)	7	1%	-90%

iTraxx Main Jan-08 to Dec-09	P&L Impact	Volatility Reduction	Max Monthly Drawdown Reduction
6-100% (No Delta)	0	-55%	-61%
22-100% (no Delta)	-1	-41%	-50%
12-22% (No Delta)	0	-44%	-41%
3-6% (Delta Scaled)	3	-19%	-35%
6-9% (Delta Scaled)	8	-50%	-64%
9-12% (Delta Scaled)	3	-50%	-72%
12-22% (Delta Scaled)	-2	-36%	-19%

iTraxx Tranches Jan-10 to Sep-11	P&L Impact	Volatility Reduction	Max Monthly Drawdown Reduction
6-100% (No Delta)	10	-57%	-56%
22-100% (no Delta)	4	-34%	-30%
12-22% (No Delta)	25	-50%	-76%
3-6% (Delta Scaled)	17	-60%	-69%
6-9% (Delta Scaled)	17	-63%	-76%
9-12% (Delta Scaled)	18	-69%	-77%
12-22% (Delta Scaled)	18	-61%	-74%

Source: Morgan Stanley Research

Trading Credit Volatility

Credit Spread Volatility Intuition: Implied Daily Spread Move

iTraxx Main daily implied spread move is 2.6bp. If you think a 2.6bp daily move (one standard deviation) is likely once every three days, buy options, otherwise sell options.

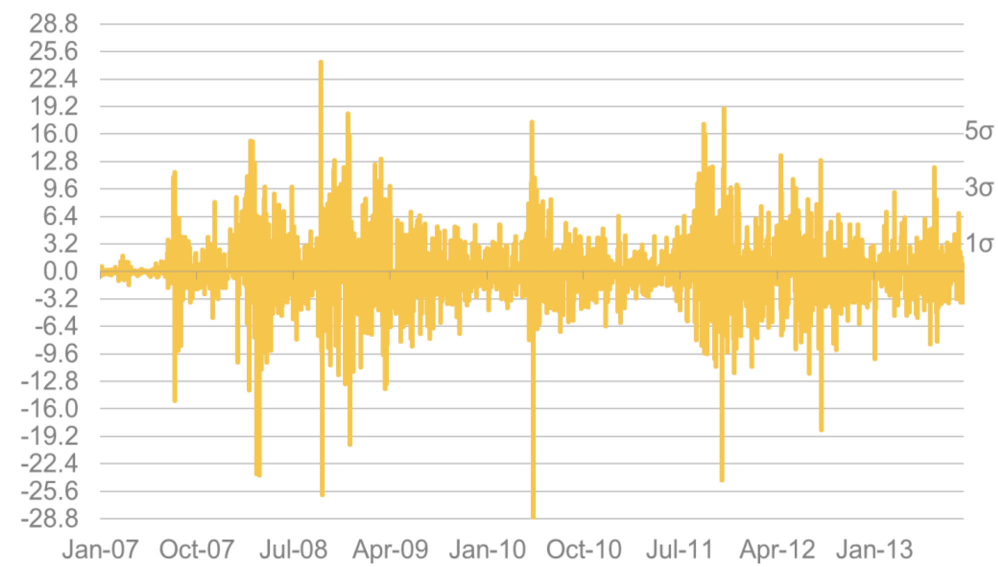
Annual Spread Volatility
iTraxx Main Spread vol = 60%

Daily Spread Volatility
= Annual Vol / Sqrt (working days)
= 60% /Sqrt (252) = 3.7%

Daily Implied Spread Move
= 3.7% x Index spread level
= 3.7% x 70bp = 2.6bp

Daily Spread Moves: iTraxx Main

Implied Spread Move vs Daily Spread Moves for Main (bp)



Note: Daily spread moves in bp

Source: Bloomberg, Morgan Stanley Research

Spread Volatility vs. Price Volatility

Credit spread volatility seen on traders' runs is not directly comparable to equity or FX volatility, which is more analogous to price volatility. Credit option prices are proportional to price volatility.

Daily Implied Spread Move
= **3.2bp**

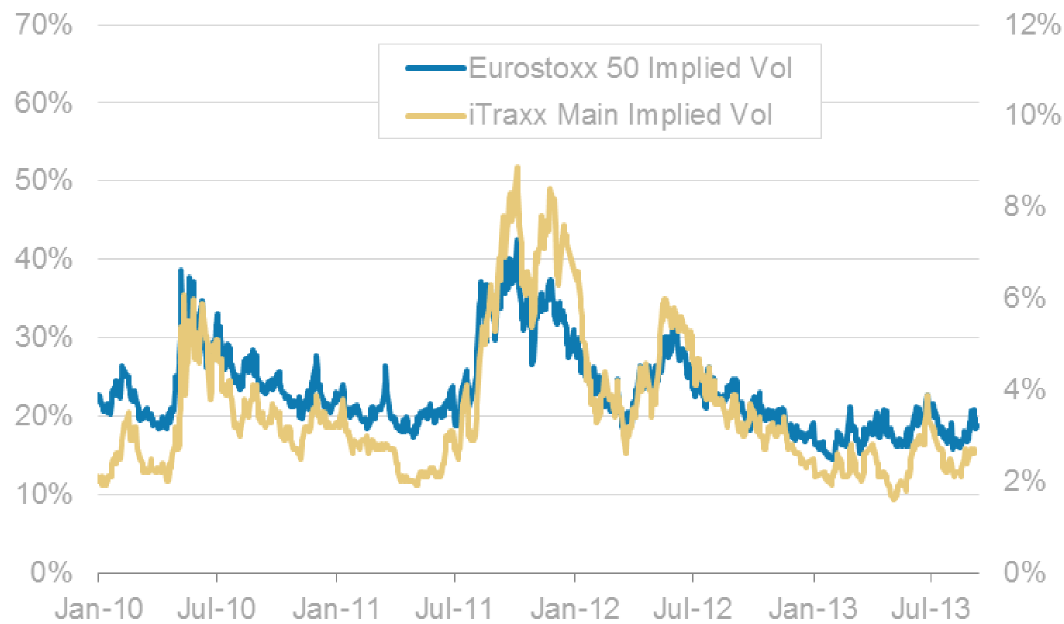
↓

Daily Implied Price Move
= Daily Implied Spread Move x Index duration / 10000
= 3.2bp / 10000 x 4.5 = 0.14%

↓

Annualized Price Volatility
= 0.14% x sqrt (working days)
= 0.14% x sqrt (252) = **2.3%**

iTraxx Main Price Volatility vs. SX5E Implied Volatility



Source: Bloomberg, Morgan Stanley Research

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(as of July 31, 2015)

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Stock Rating Category	Count	% of Total	Count	% of Total IBC	% of Rating Category
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Equal-weight/Hold	**1449**	**43%**	**325**	**44%**	**22%**
Not-Rated/Hold	**93**	**3%**	**10**	**1%**	**11%**
Underweight/Sell	**623**	**19%**	**78**	**11%**	**13%**
Total	**3,363**		**734**		

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