

December 2013

# Credit Index Options 1-0-1

Launching our option pricing tool @ CitiVelocity

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**See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures**

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Prepared 2 December 2013.

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# Agenda

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**What trades?**

State of the options market

Resources at Citi

P&L & MtM Drivers

Skews? An extra layer of useful information

What should you be watching for?

Popular no-delta trades

Trading vol

Option pricing tool @ CitiVelocity

# Options on CDS Indices

- Option to buy / sell protection at a future date at an agreed spread
- **Underlying: 5y CDS indices** – iTraxx Europe, Crossover, Senior Financials, CDX IG, CDX HY
  - The liquidity is mainly in **on-the-run** indices.
- Main features:
  - **European style**: only exercisable at expiry (from 9am to 4pm).
  - **Up to 9 months expiries quoted**. Expiry date on the 3<sup>rd</sup> Wednesday of the month.
  - **Strike** is generally quoted **in spread**; except for CDX HY where strikes are quoted in price.
  - **Option price** quoted **in cents** of the traded notional – 100 cents = 1% (paid trade date + 3 days).
  - **Settlement: Physical** – i.e. if the option is exercised the investor enters an index position (expiry + 3 days).

## Receiver options

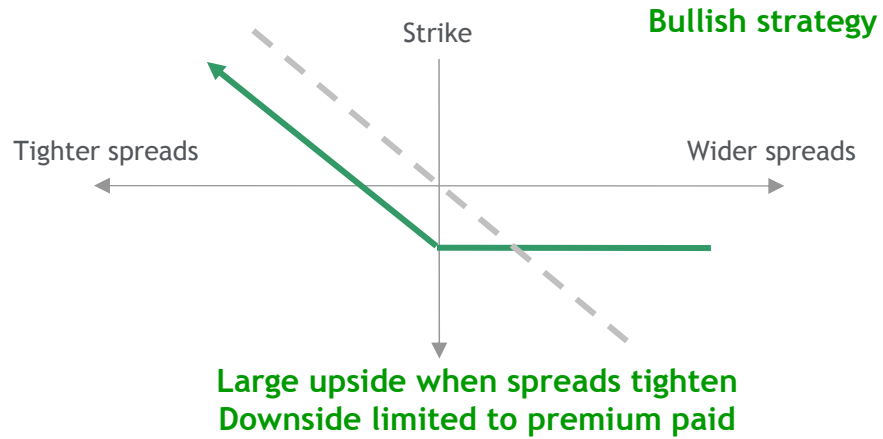
- ▶ Right to **SELL PROTECTION** ...
  - ▶ at expiry, at a spread equal to the agreed strike.
- ▶ Buy receivers – bullish spread view.
- ▶ Sell receivers – bearish spread view.
- ▶ They are also referred to as “call” options.

## Payer options

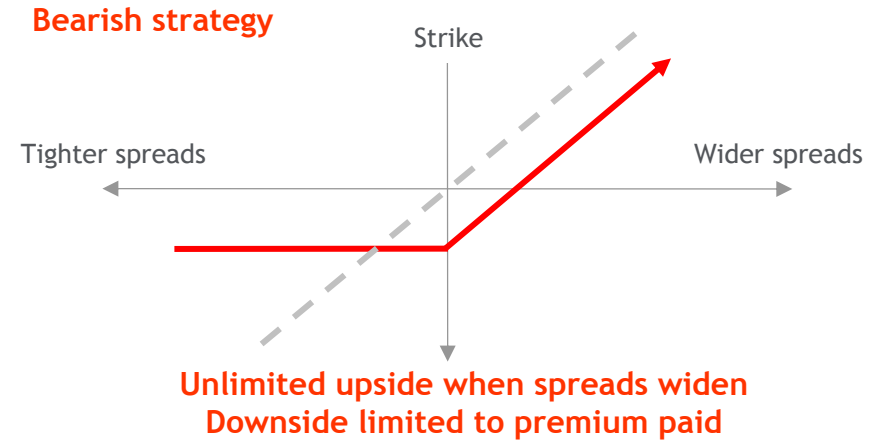
- ▶ Right to **BUY PROTECTION** ...
  - ▶ at expiry, at a spread equal to the agreed strike.
- ▶ Buy payers – bearish spread view.
- ▶ Sell payers – bullish spread view.
- ▶ They are also referred to as “put” options.

# Graphically ...

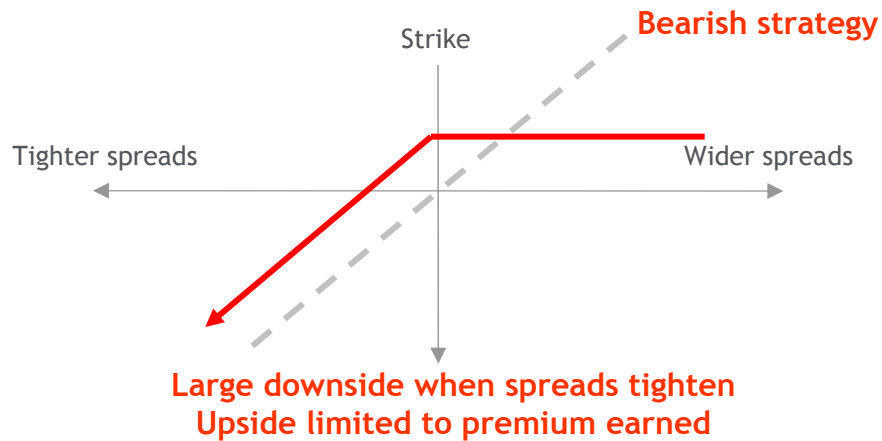
## Buy Receiver



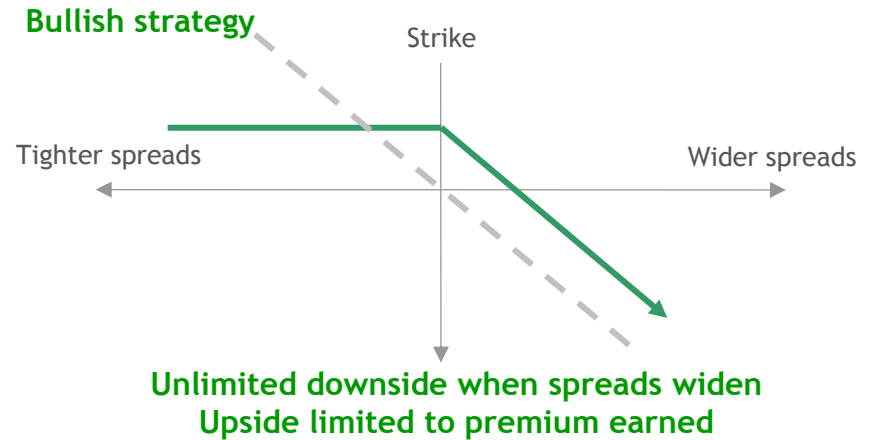
## Buy Payer



## Sell Receiver



## Sell Payer



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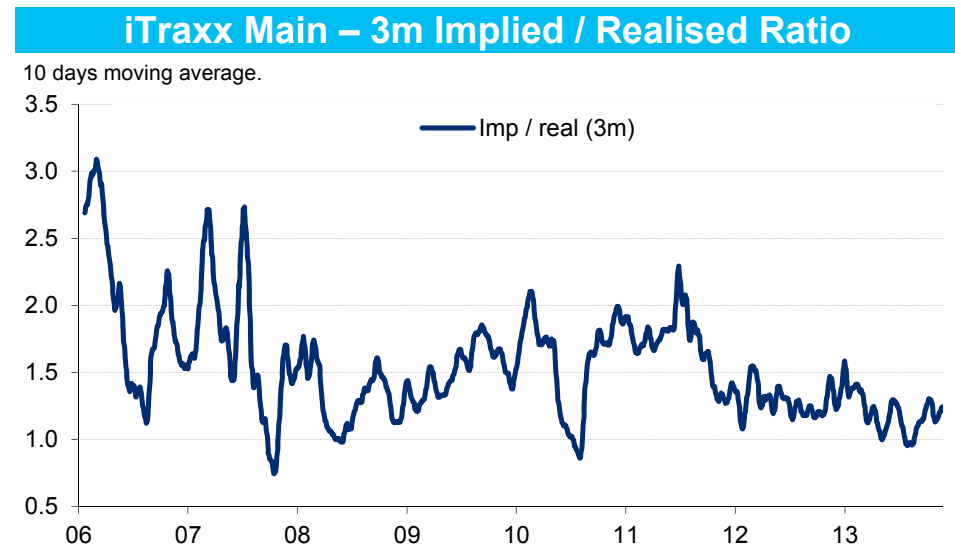
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# History

- **Before 2009:** Limited liquidity.
- **2009/10:** Investors realise that hedging tails / basis / negative convexity is actually not such a bad idea and the option's market starts getting plenty of traction.
  - Clients buying options to hedge (loan, correlation, CVA desks ...) with dealers & hedge funds on the other side.
  - Implied vol (i.e. demand for options) very elevated vs. realised (i.e. "fair value").
- **2011:** The options market attracts investors looking to profit from the disconnect between implied and realised vol.
  - Liquidity improves and volumes keep growing.
- **2012/13:** The market continues growing and consolidating with more involvement from real money investors and smaller funds.
- **2014?** Consolidation, more real money participation.



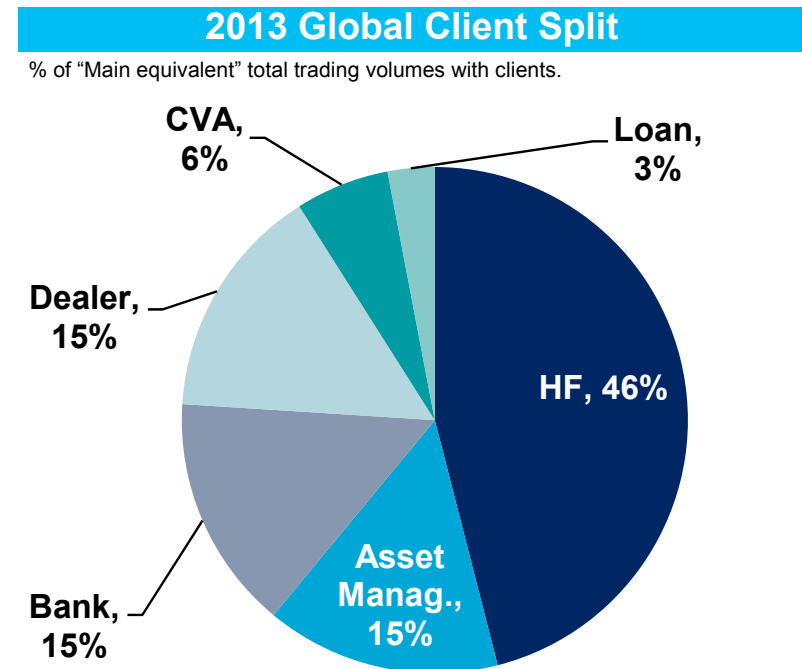
# 2013 – iTraxx Options Overview

## ■ 2013 volumes

- From Jan. to Nov. 2013 we traded **2.5-3x more than** what we traded in 2012.
- Split across indices (“Main equivalent adjusted delta”): **62% Main, 31% Xover, 7% Senior Fin.**
- We (roughly) estimate that **the options market generates around 10 / 15% of the volumes in the index market.**

## ■ Client split

- Compared to the US, **Europe sees:**
  - **More trading from CVA and structuring desks,**
  - **Less trading from loan desks and real money (RM) investors.**
- **Real Money progressively more involved**



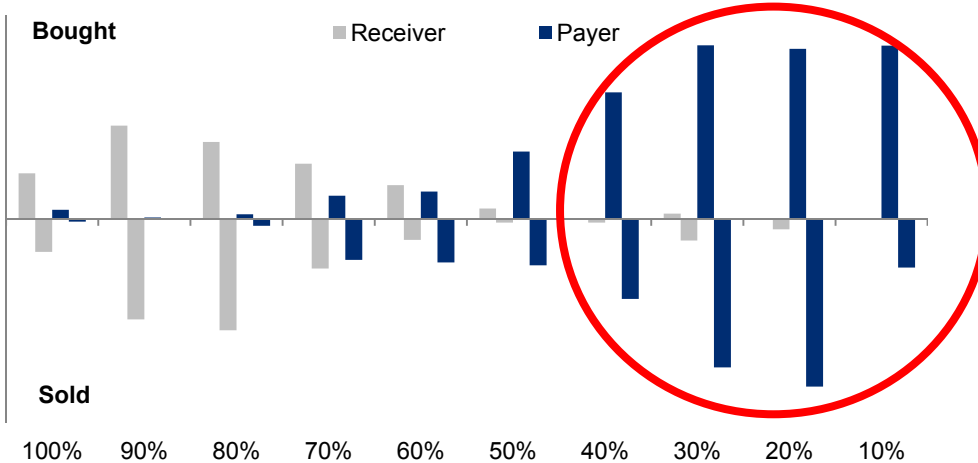
Source: Citi Research, Markit. Includes options across all indices. We use the following betas to compute “Main equivalent” volumes: 4x for Crossover, 1.5x for Senior Fin.



# 2013 - iTraxx Options Overview

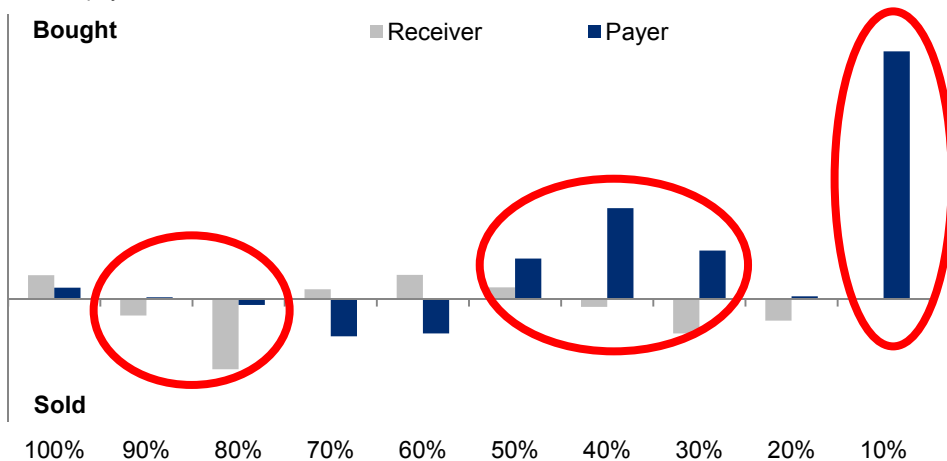
## Volumes per payer delta (not delta-adjusted)

Y-axis: "Main equivalent" trading volumes. Bought/sold: Client point of view. X-axis: payer delta.



## Net volumes per payer delta (not delta-adjusted)

Y-axis: "Main equivalent" trading volumes. Net = bought – sold. Bought/sold: Client point of view. X-axis: payer delta.



### Payers trade much more

- ▶ Still a **"hedging"** market for most investors

### Clients are net buyers of payers

- ▶ Especially very OTM payers, i.e. **tail-hedging**

### On the receiver side, selling slightly OTM receivers is the most popular strategy on a net basis

- ▶ **Covered receivers to enhance the carry of long risk portfolios** without adding long risk exposure

Source: Citi Research, Markit. Includes options across all indices. We use the following betas to compute "Main equivalent" volumes: 4x for Crossover, 1.5x for Senior Fin.

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# Resources at Citi

## ■ Credit derivatives **RESEARCH**

- Abel Elizalde – Europe
- Anindya Basu – US

## ■ **ANALYTICS**, Market snapshot & Axes on Citi Velocity

- Credit options daily analytics
- Credit options market snapshot

## ■ Comprehensive **DATA** available on Citi Velocity

- Implied and realised volatilities
- Forwards and strikes per delta across tenors

## ■ Online **PRICING** tool on Citi Velocity

- Ability to price options and analyse trade ideas.



### iTraxx Volatility Report

See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures

Data as of COB 22 Nov 13

	3m Implied vol (%)	1w chg	1m chg	3m Real. vol (%)	1w chg	1m
Main	43	-2	2	36	-1	
Crossover	38	-2	2	31	-1	
SenFin	47	-1	2	40	-1	

	6m Implied vol (%)	1w chg	1m chg	6m Real. vol (%)	1w chg	1m
Main	47	-2	3	45	-2	
Crossover	42	-2	2	41	-1	
SenFin	48	-1	1	50	-2	

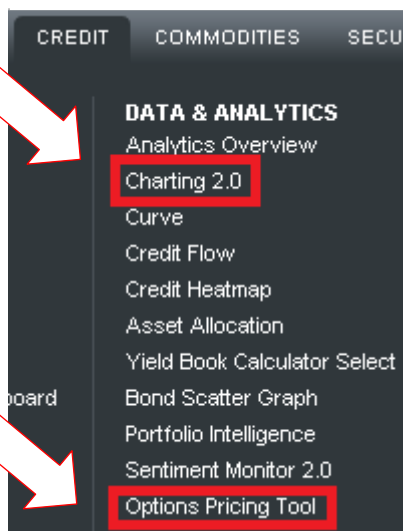
### CDX Volatility Report

	3m Implied vol (%)	1w chg	1m chg	3m Real. vol (%)	1w chg	1m chg
CDX IG	38	-2	-3	34	-2	-3
CDX HY	38	-2	-1	30	-3	-4
CDX EM	69	0	3	40	-2	-3

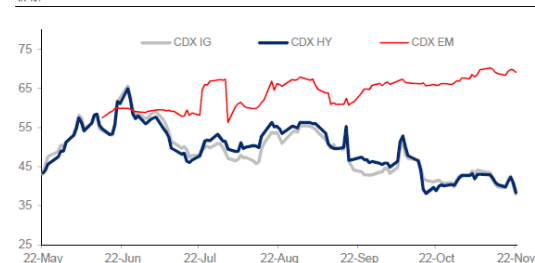
  

	6m Implied vol (%)	1w chg	1m chg	6m Real. vol (%)	1w chg	1m chg
CDX IG	44	-0	0	40	-0	-1
CDX HY	46	1	3	40	-0	-2
CDX EM	71	0	3	49	0	1

### Citi**VELOCITY**



3m ATM Implied volatility  
In %



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# Index spread, implied vol, defaults ... and time

## ■ What are the main drivers of an option P&L @ expiry?

- **Index spread @ expiry**
- **Defaults** in the index before expiry

## ■ And MtM before expiry?

- Index spread
- Defaults in the index
- **Supply/demand for the option – implied volatility**
- **Time going by**

### Buyer of a payer option

- ▶ Makes money if:
  - ▶ Spreads go up
  - ▶ Implied volatility goes up
  - ▶ Defaults happen
- ▶ Loses money if:
  - ▶ Time goes by, other things equal

### P&L at expiry \*

$$\max[0, (Spread - Strike) \cdot Duration] - Price$$

### Buyer of a receiver option

- ▶ Makes money if:
  - ▶ Spreads go down
  - ▶ Implied volatility goes down
- ▶ Loses money if:
  - ▶ Defaults happen
  - ▶ Time goes by, other things equal

### P&L at expiry \*

$$\max[0, (Spread - Spread) \cdot Duration] - Price$$

\* The calculations above are an easy, and good enough in most cases, shortcut to compute the P&L of an option – as long as (i) there are no defaults in the underlying index and (ii) the spread of the index and the option strike are not too different this approximation works fine. However, the “proper” P&L calculations are slightly different ... more on this later ...

# Spread exposure: Delta

- **Directional (i.e. spread) exposure of an option.**
- Index position which generates a similar spread exposure as the option (in MtM terms) for small spread movements.
  - Example – If you buy 100m of a payer option with a 60% delta, you would need to sell 60m of index protection for the MtM of your entire position to be neutral to small spread changes.
- **Payers = positive delta**
- **Receivers = negative delta**
  - Delta falls as options become more OTM  
(e.g. a 120 strike payer in Main has a lower delta than a 90 strike payer)
- **Approximate probability that the option ends up in the money.**
  - E.g. if a 3m 150bp strike payer in Main has a 5% delta, that (roughly) means the probability of Main being wider than 150bp in 3m time is 5%.

Underlying	
Pricing date	27-May-13
Index	Main S19 5y
Spread	98 bp

Initial option pricing	
Expiry	27-Aug-13
Type	Payer
Strike	100
Price (cents)	57

Implied vol.	51%
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Delta	60%
Option "Duration"	2.9
Index Duration	4.9

Gamma	0.8%
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Theta	-0.4 c
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Vega	0.9 c
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# Implied Vol: Demand for options

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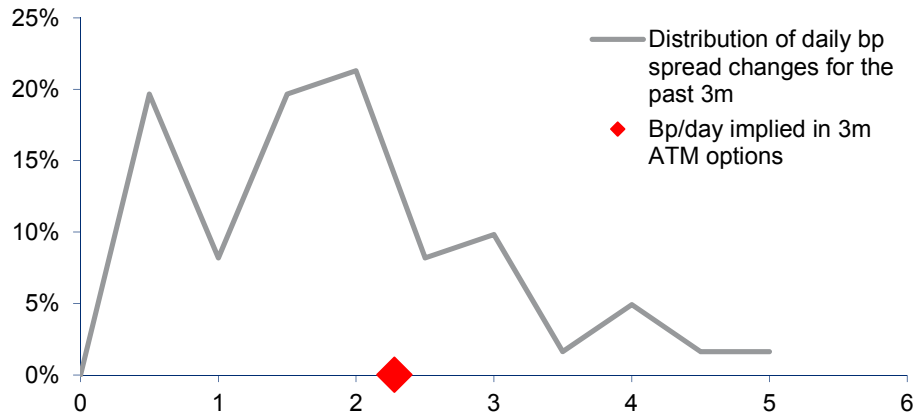
- Implied volatility is a parameter which **captures the supply-demand balance for a given option**
  - ... once everything else is taken into account (index spread and the default risk of the underlying names).
  
- **Changes in implied vol tell us if option prices moved more or less than what the change in spreads justify.**
  
- Don't be fooled ... when you hear people saying: They just mean:
  - **Implied vol is going up ..... The demand to buy options has increased.**
  
- **If option prices go up**, with index spreads not moving, **it must be because ....**
  - investors believe the **volatility / uncertainty / magnitude of potential spread changes** (either way) has increased.

# Implied Vol: Demand for options

- Standard is to look at implied vol in annualised percentage spread changes – e.g. Main 3m implied vol ~43% currently.
- Judging if demand for options (i.e. implied vol) is high or low
  - Compare with **“fair value” – i.e. realised index vol**
    - E.g. Main 3m realised vol ~36% currently
  - Express it as **daily bp spread movement**
    - E.g. Main 3m implied vol ~2.5 bp/day currently
    - E.g. Main 3m realised vol ~2 bp/day currently

## Distrib. of daily bp changes vs. implied daily bp vol.

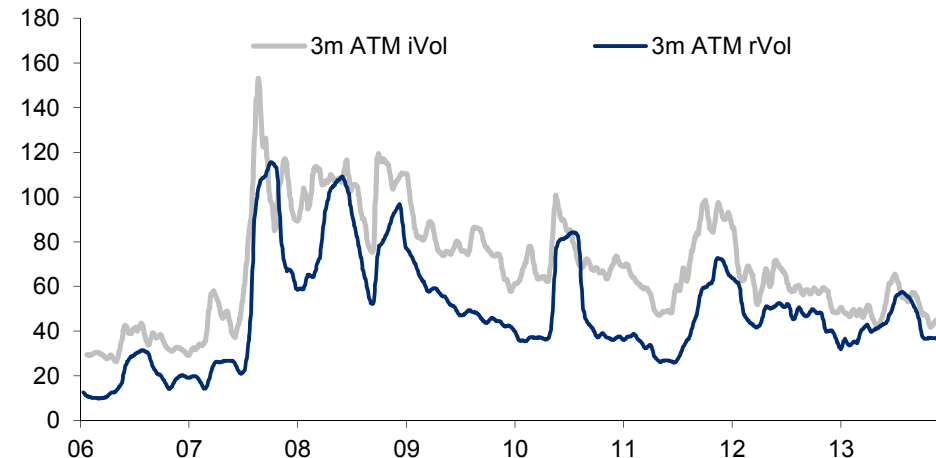
3m of historical spread data and 3m implied vol. X-axis: daily bp changes. Y-axis: % of days.



$$\text{Daily bp vol} = \text{Annual \% Vol} \times \text{Spread} / \text{Square root 252}$$

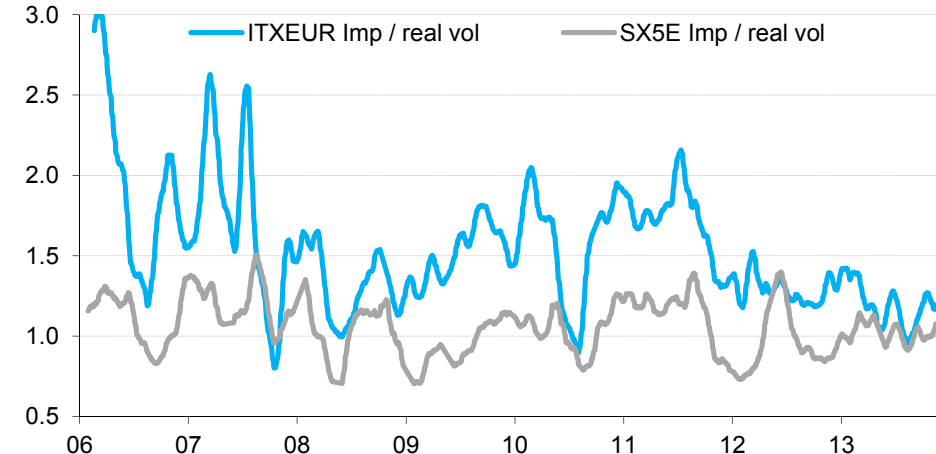
## iTraxx Main– 3m Implied vs. Realised Vol

In %. 10 days moving average.



## Credit vs. Equities – Implied / Realised Ratio

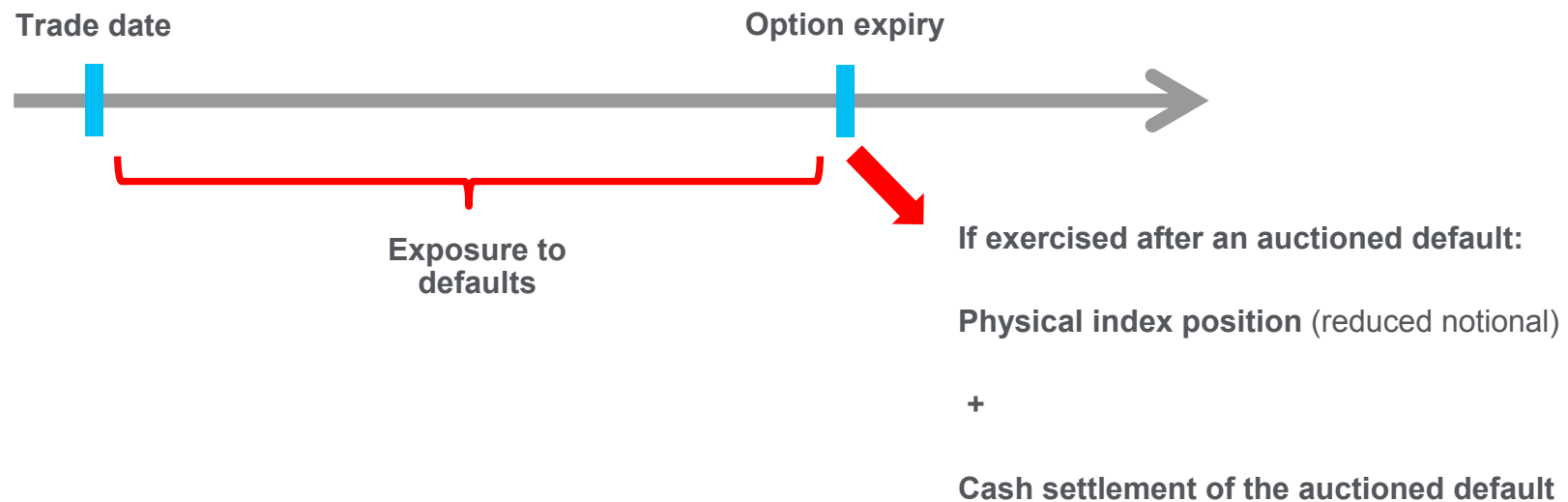
20 days moving average; 3m options.





# Default exposure

- CDS index options provide:
  - 1. An option on the (forward) index spread, plus
  - 2. Exposure to the defaults on the index from the date the option is traded until expiry
    - Defaults will be settled at the option expiry (not at the auction date).
    - Defaults (like spread widenings) benefit: buyers of payers / sellers of receivers.

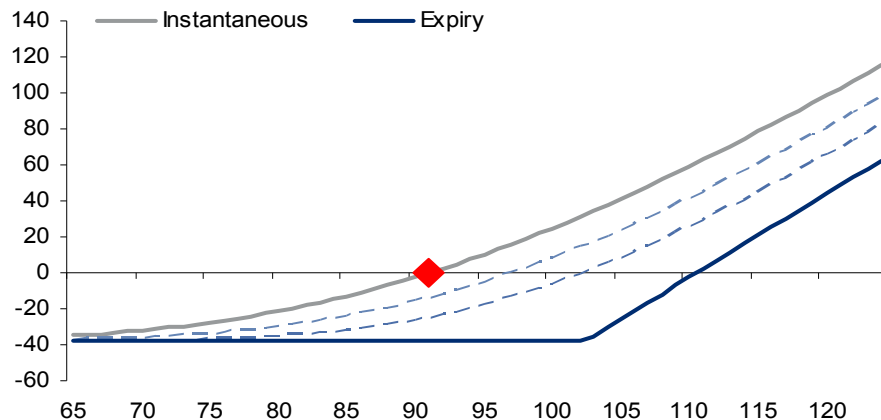


# Time exposure: Theta

- Change in the option price if 1 day goes by.
- If you buy an option, how much do you lose (in cents) in one day if everything else (spreads, volatility, rates, defaults) remains constant?
- Buying options** (both payers & receivers\*) generates a **negative theta**.

## Spread exposure of a payer option

P&L vs. index spread levels. In cents of notional traded (100 cents = 1%).



### Underlying

Pricing date	27-May-13
Index	Main S19 5y
Spread	98 bp

### Initial option pricing

Expiry	27-Aug-13
Type	<b>Payer</b>
Strike	100
Price (cents)	<b>57</b>

Implied vol.	<b>51%</b>
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Delta	<b>60%</b>
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Option "Duration"	2.9
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Index Duration	4.9
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Gamma	<b>0.8%</b>
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Theta	<b>-0.4 c</b>
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Vega	<b>0.9 c</b>
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**Skews? An extra layer of useful information**

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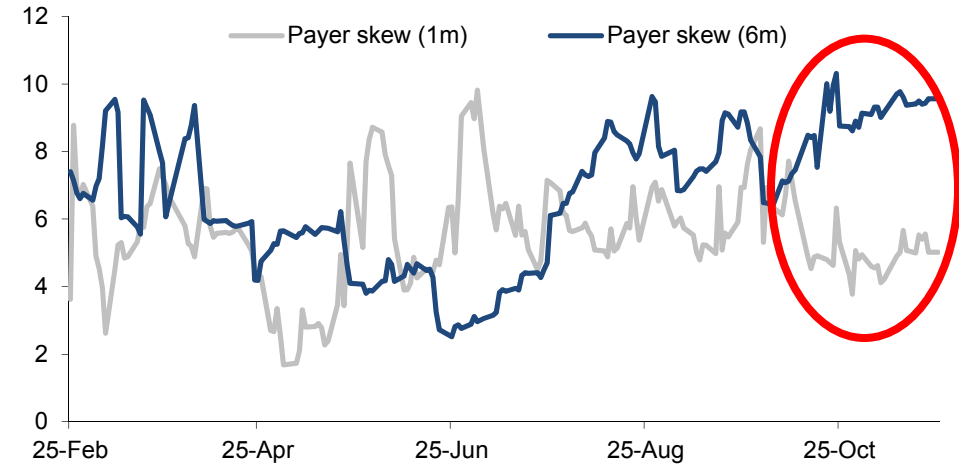
Option pricing tool @ CitiVelocity

# Volatility Skew

- Vol going up may be informative, but it'll be more informative to know whether the options that investors want to buy are ... high strike payers for hedging, or low strike receivers to add risk.
- Skew: Implied vol difference (i.e. demand) for options with different strikes:**
  - Receiver skew:** vol difference between spot and tight strikes
  - Payer skew:** vol difference between wide strikes and spot

## Payer skews across expiries

Implied volatility difference between payer options with 25% delta and with 50%. In %.



	Flattens	Steepens
<b>Receiver skew</b>	<b>Bullish</b> Demand to buy OTM receivers	<b>Bearish</b> Demand to sell OTM receivers
<b>Payer skew</b>	<b>Bullish</b> Demand to sell OTM payers	<b>Bearish</b> Demand to buy OTM payers

(Always relative to ATM options)

- Vol “going up” doesn’t have to be a bullish or a bearish signal
- It is how vol movements affect the skew which give us clues about whether the flows in the options market are bullish or bearish**

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# What should you be watching for?

## ■ Movements in implied vol: alone and vs.

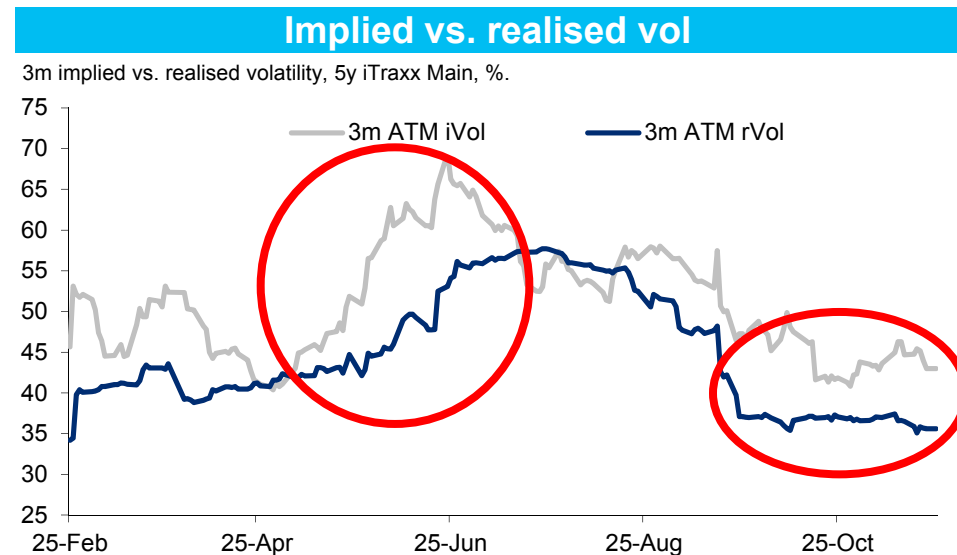
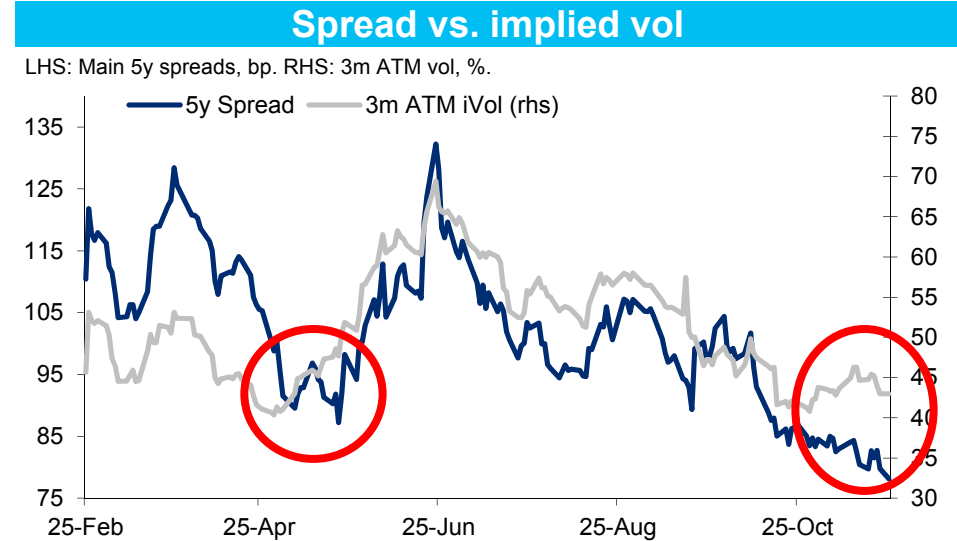
### ■ Spread movements

Are they moving in opposite directions?

Beware when spreads keep tightening but implied vol starts going up

### ■ Realised volatility

Diverging too much?



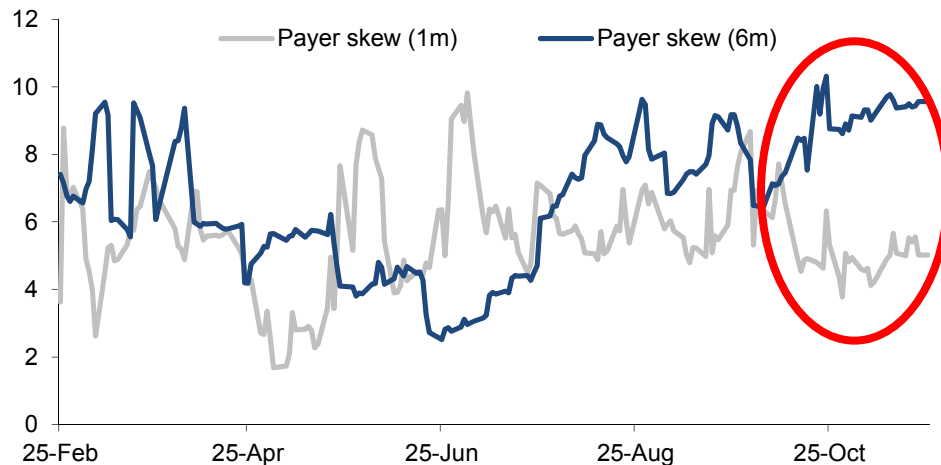
# What should you be watching for?

## ■ Movements in skews:

- **Steepening? ... Bearish flows**
  - Sellers of receivers / Buyers of payers
- **Flattening? ... Bullish flows**
  - Buyers of receivers / Sellers of payers
- **Are skews different across expiries?**

### Payer skews across expiries

Implied volatility difference between payer options with 25% delta and with 50%. In %.

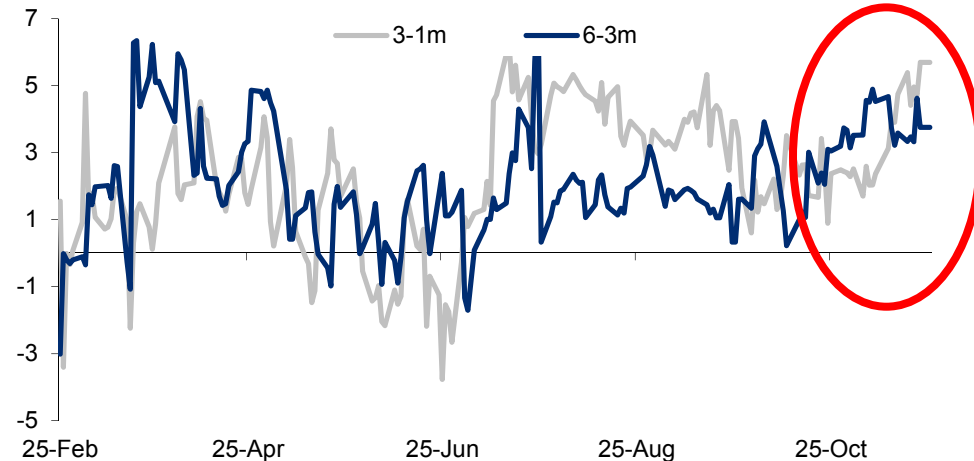


## ■ Movements in term structure:

- **Inverted?**
  - Investors over-reacting to short term concerns
- **Too steep?**
  - Investors very relaxed about short term risk

### Term structure of implied vol

Implied volatility difference between ATM options with different expiries. In %.



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# Hedges

## Buy Payer

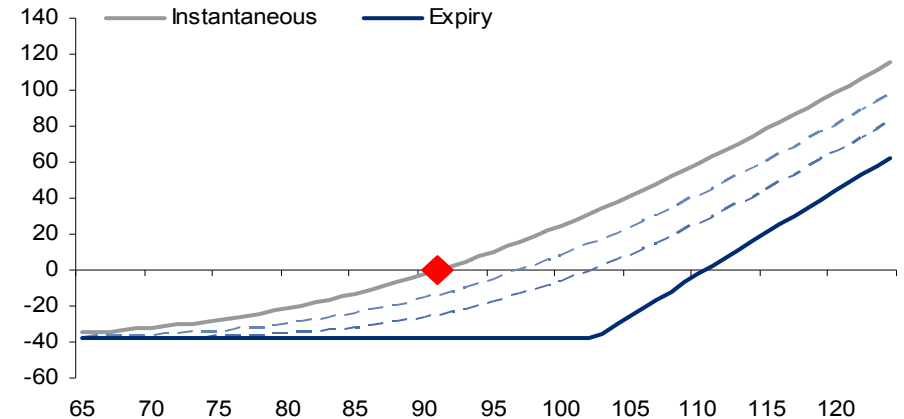
- **View:**  
  
Spreads will widen, but want to limit the exposure to spread tightenings.
- Generally bought for **tail-risk protection**

## Payer spread

- **Position for moderate widenings**, with limited exposure to large spread movements (either way).
- Construction: Buy a low strike payer & sell a high strike payer.
- **Best when: Skew is steep** – which is generally the case in credit given the demand for OTM payers as cheap tail hedges.

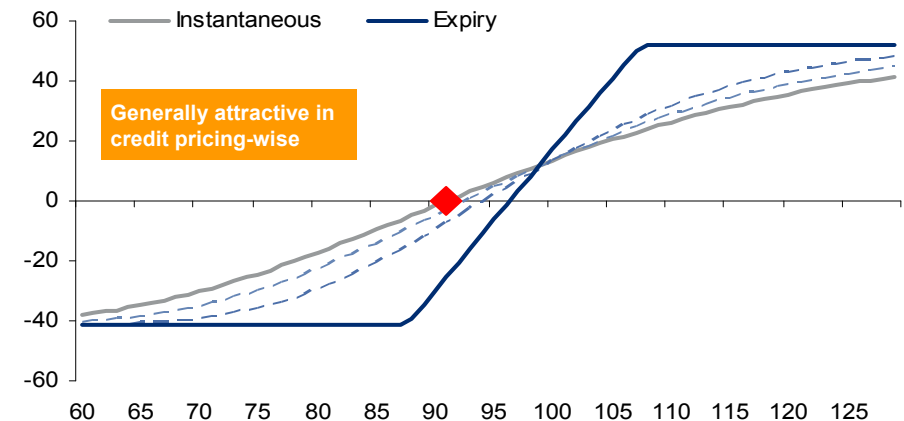
## Spread exposure

P&L vs. index spread levels. In cents of notional traded (100 cents = 1%).



## Spread exposure

P&L vs. index spread levels. In cents of notional traded (100 cents = 1%).



# “Alpha” – involves selling options

## Sell Straddle

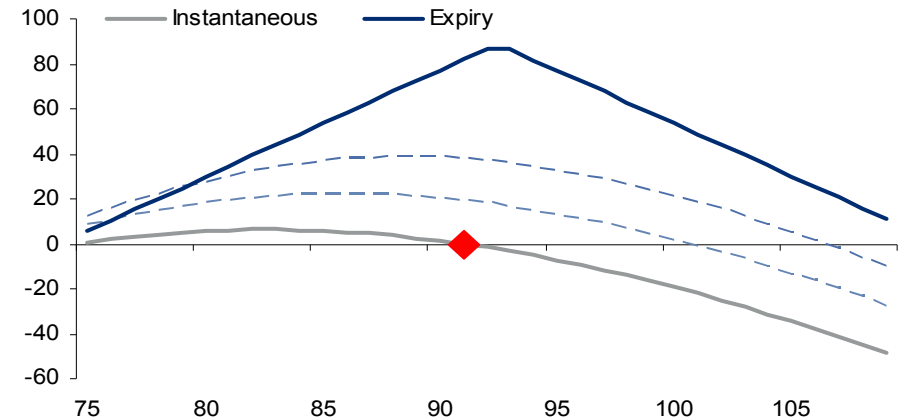
- **View: Spreads to remain range-bound around current levels**
- Best when: implied vol is high.
- Construction: sell one payer and one receiver with the same strike.
- Similar strategies: strangles, condors, butterflies.

## Sell receiver

- **View: Spreads to either remain around the same levels or drift wider.**
- **“Covered receiver”** – Way to add carry to long risk portfolios without adding directional risk.

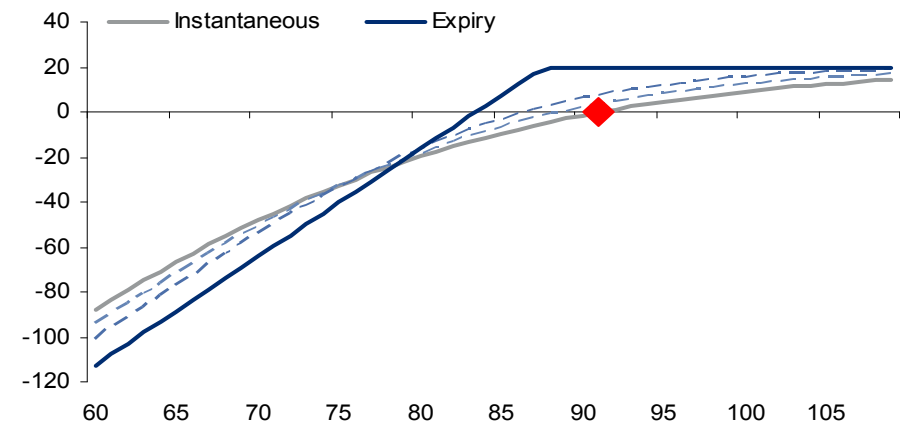
## Spread exposure

P&L vs. index spread levels. In cents of notional traded (100 cents = 1%).



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P&L vs. index spread levels. In cents of notional traded (100 cents = 1%).



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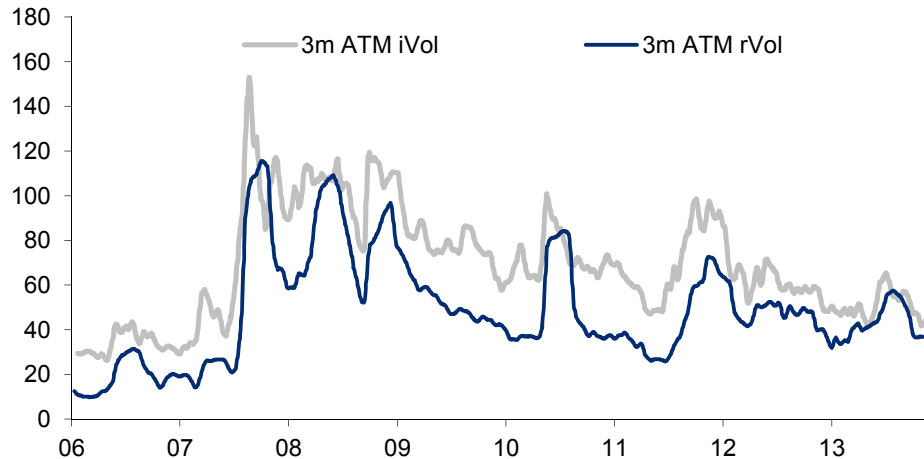
# What do we want to trade?

- If we were to go “long vol”, we would like to **profit from either**:
  - **Higher levels of uncertainty (i.e. implied vol) priced in the market.**
    - Because investors believe future volatility will increase
    - Even if index spreads do not move.
  - **Index spreads “fluctuating” more than what the market expects them to.**

... without taking a directional view on spreads.

## iTraxx Main– 3m Implied vs. Realised Vol

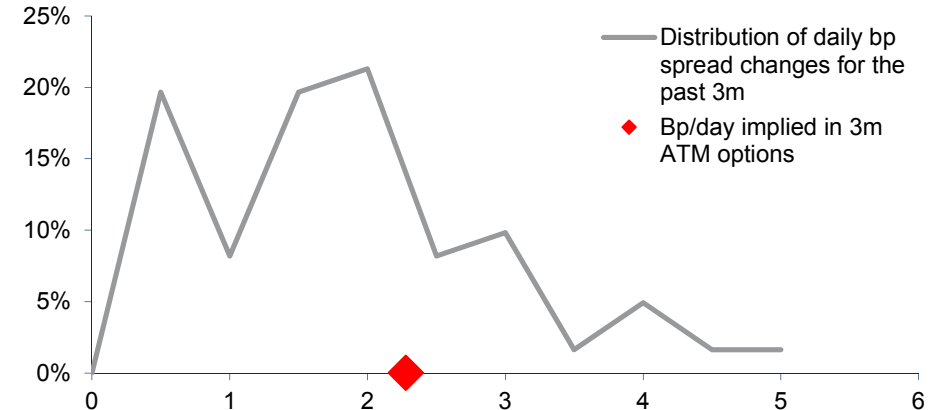
In %. 10 days moving average.



Source: Citi Research.

## Distrib. of daily bp changes vs. implied daily bp vol.

3m of historical spread data and 3m implied vol. X-axis: daily bp changes. Y-axis: % of days.



$$\text{Daily bp vol} = \text{Annual \% Vol} \times \text{Spread} / \text{Square root 252}$$

# How do we trade it? Delta-hedged options

- Delta-hedging options provides exposure to three (related) risk dimensions:

- Changes in implied volatility** (“Vega trading”)

- Changes in spreads** (“Gamma trading”)

Buying a delta-hedged option benefits from any instantaneous movement in index spreads and for increases in implied vol.

- Time passing by** (“Theta” exposure).

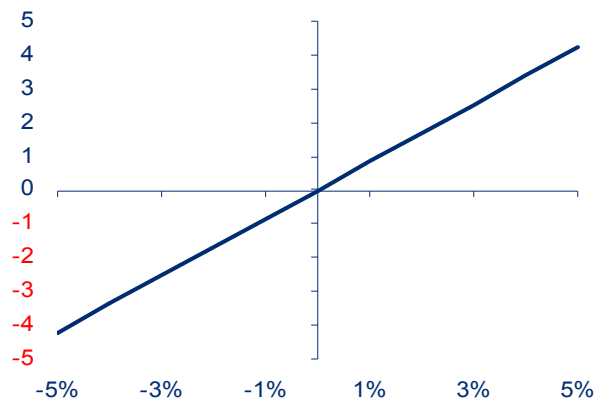
The “cost” of the trade is its negative theta.

- “Gamma” and “Theta” exposure can be combined into:

- Profit if index spread moves more than what was “implied” by the implied vol at which we bought the option.**

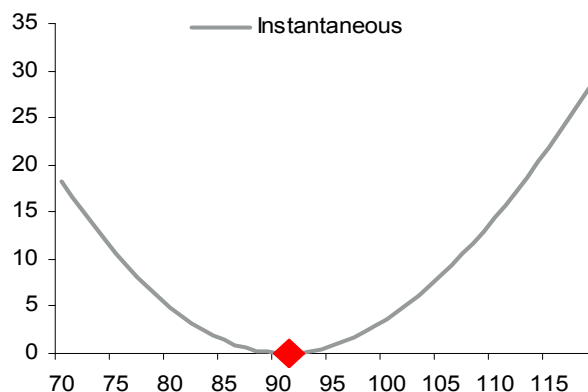
## Vol exposure

Y-axis: MtM in cents. X-axis: change on implied vol.



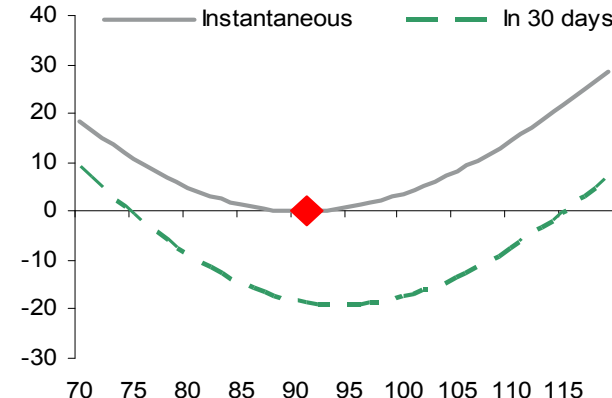
## Initial spread exposure ...

P&L vs. index spread levels (bp). In cents of notional traded.



## ... suffers from the negative theta

P&L vs. index spread levels (bp). In cents of notional traded.

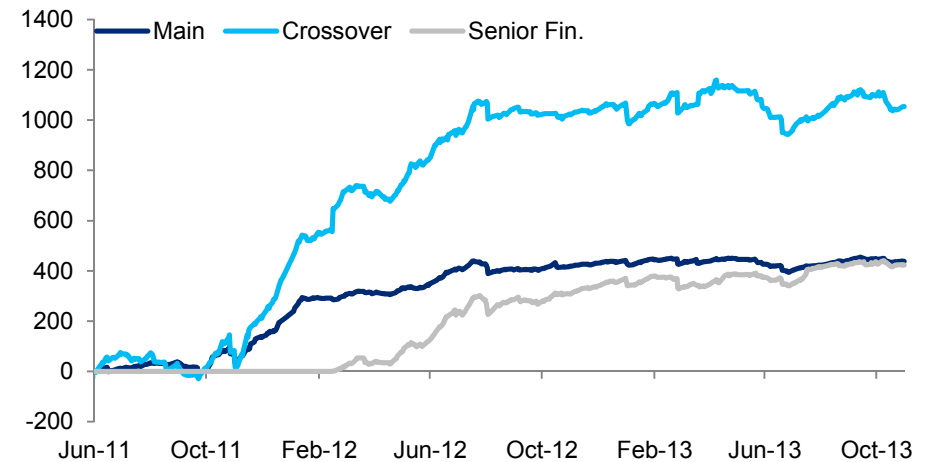


# Historical P&L of selling volatility in credit indices

- ▶ Historically, the “gamma” component of the P&L dominates
  - ▶ I.e. at least in credit, when we trade “vol” we are mostly trading “gamma” (i.e. spread changes), not “vega” (i.e. vol changes).
  - ▶ Mostly due to the short term nature of these options.
- ▶ Positive P&L historically, decreasing as the gap between implied and realised volatility in credit narrows

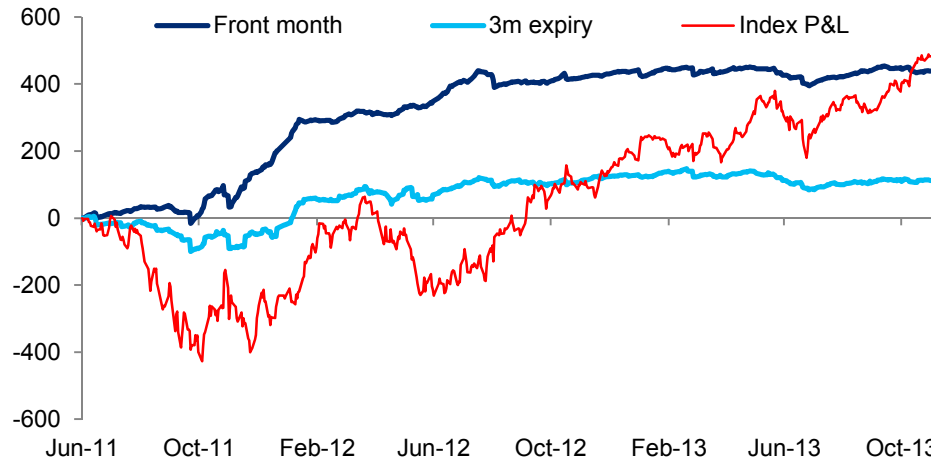
## Selling front month delta-hedged straddles

Net cumulative P&L after transaction costs. Cents of notional traded.



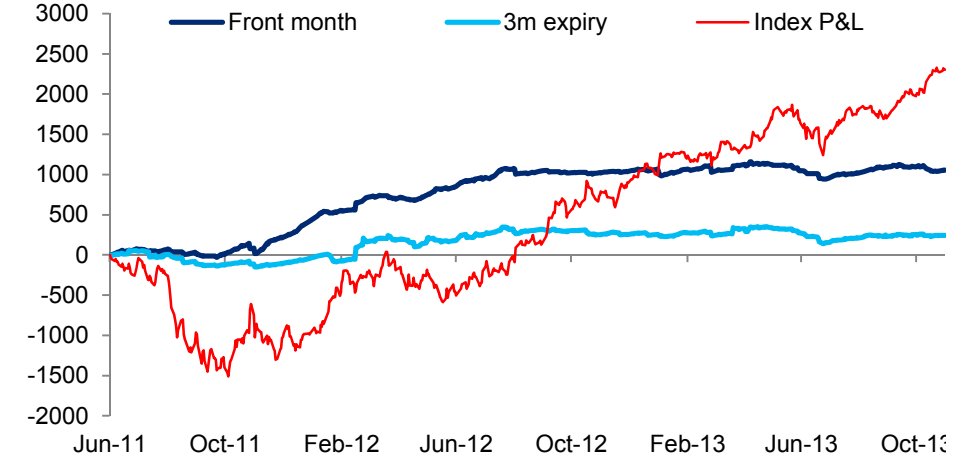
## Main – selling vol vs. selling index protection

Net cumulative P&L after transaction costs. Cents of notional traded.



## Xover– selling vol vs. selling index protection

Net cumulative P&L after transaction costs. Cents of notional traded.



# Agenda

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What trades?

State of the options market

Resources at Citi

P&L & MtM Drivers

Skews? An extra layer of useful information

What should you be watching for?

Popular no-delta trades

Trading vol

Option pricing tool @ CitiVelocity

# Credit Options Pricing Tool on Citi Velocity Web

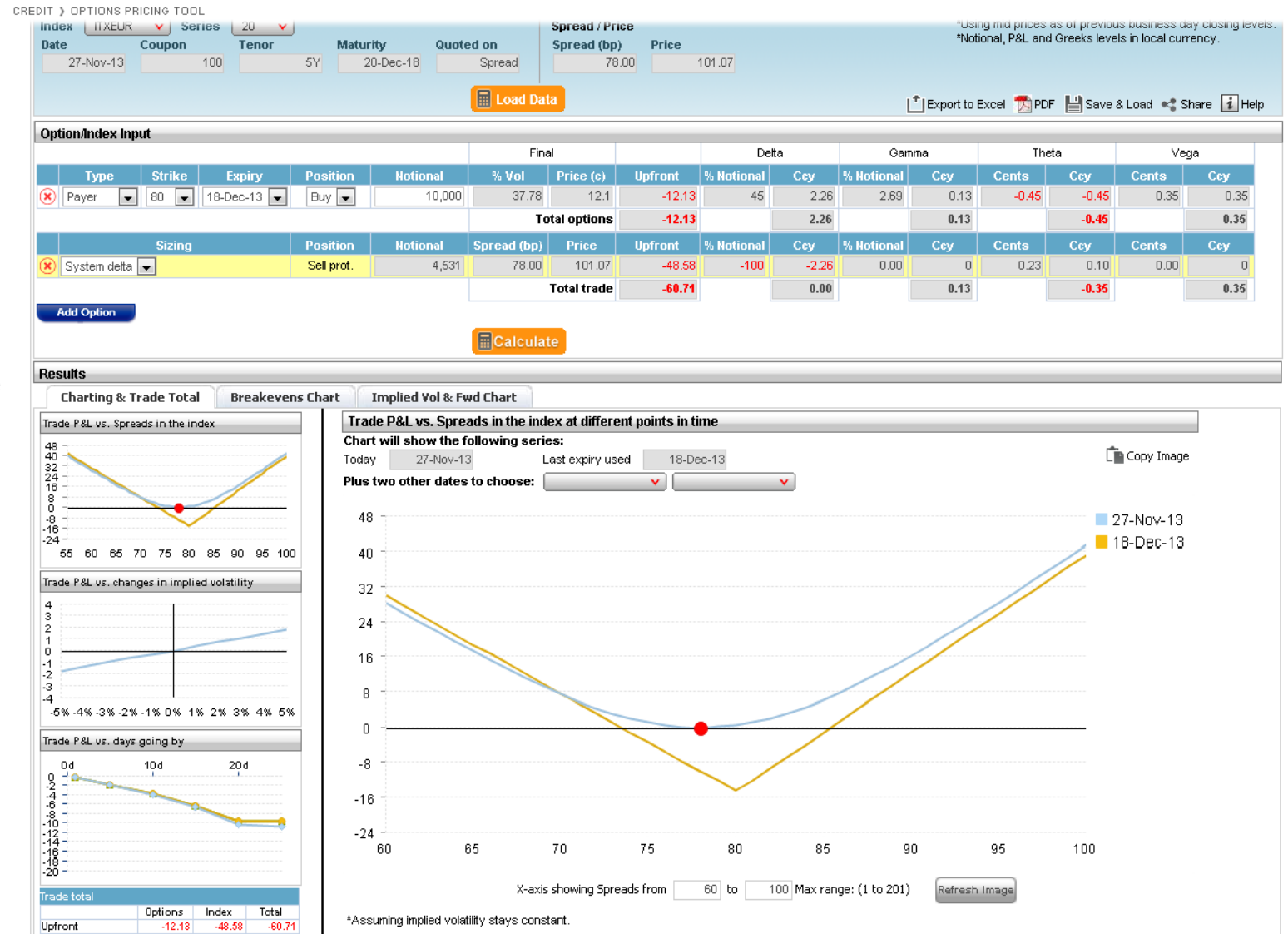
- Your new central access point for pricing and analysing credit index options (iTraxx & CDX) to generate more effective trade ideas

- Quickly analyse the **P&L profile** of option trades

- Access **interactive and flexible charts** to visualise exposure to spreads, volatility and time to expiry

- Easily generate **PDFs**, including trade details and graphic analysis, or export results to directly to **Excel**

- Available for **iTraxx Main**, **Xover** and **Senior Financials** as well as **CDX IG, HY and EM**



Source: Citi Research. Results may vary with each use and over time. IMPORTANT: The projections or other information generated by this tool regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results and are not guarantees of future results.



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