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European High Yield and Leveraged Finance Conference 2016

Quantitative reality: Theory versus practice in HY investment strategy

19 September 2016

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Introduction

- We cover two topics from different perspectives

- Performance of synthetic vs cash bonds in HY markets
  - Why have iTraxx.XO and CDX.HY outperformed bond indices?
  - What drives the synthetic-cash basis in HY markets
  - For in-depth analysis on this topic, please refer to:

  Synthetic vs. Corporate Bond Indices: Why CDX.HY and iTraxx XO have outperformed Barclays High Yield Bond Indices

- Hedging HY portfolios
  - Comparing the efficacy of equity instruments to synthetic credit
  - Using iTraxx swaptions
  - For in-depth analysis on this topic, please refer to:

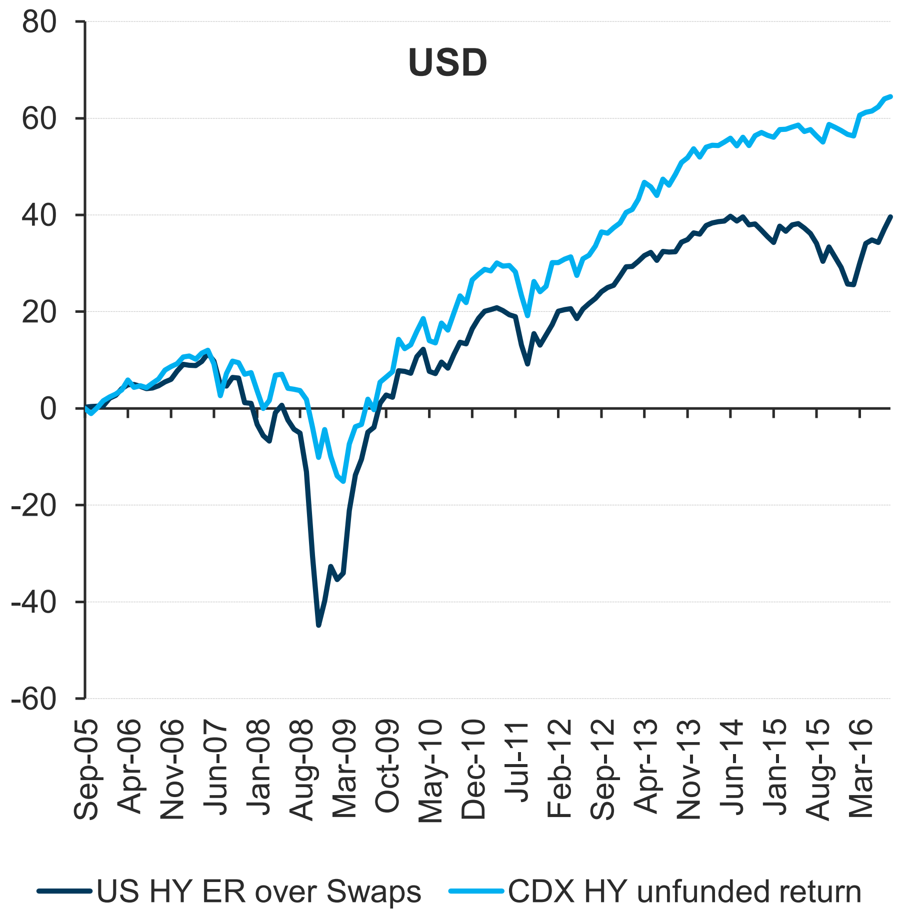
  Hedging Systematic Risk in High Yield Portfolios with a Synthetic Overlay. A Comparative Analysis of Equity Instruments Vs. Credit Default Swaps

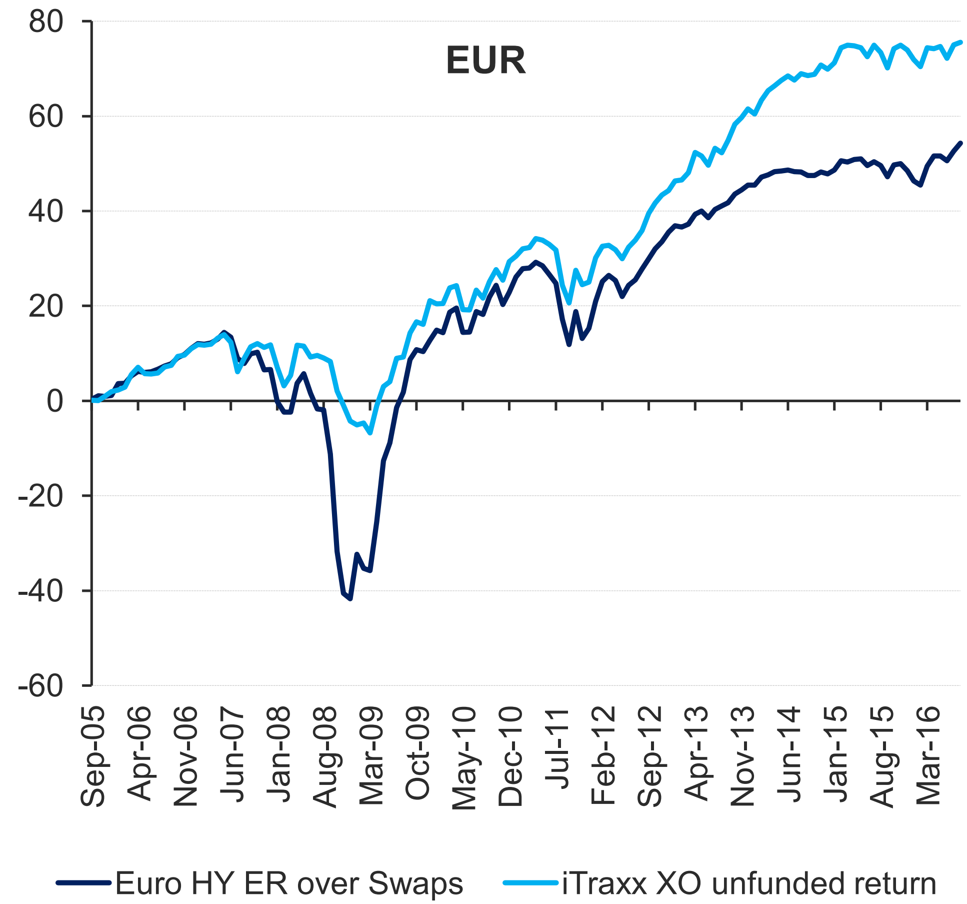
Performance of CDS vs Bond Indices

HY CDS baskets have outperformed bond indices

- Selling protection on the on-the-run CDS HY indices has outperformed Bloomberg Barclays HY Bond Index (excess return over swaps) in the past decade in both US and Euro markets

Synthetic has outperformed cash HY



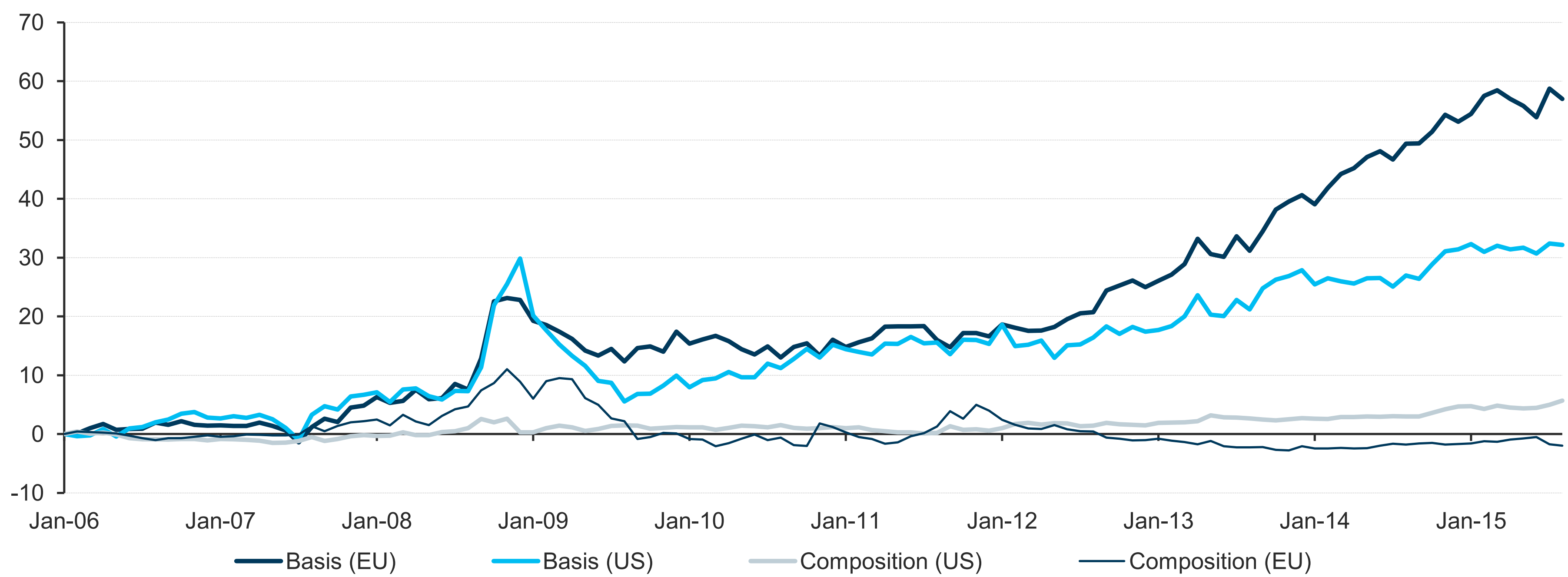


Sources for all charts: Bloomberg Barclays Indices; Barclays Research

CDS outperformance is not due to differences in composition

- We attribute the return differences between CDS and bond indices to two broad sources:
  - **Composition:** Difference between a CDS-mapped bond portfolio and the bond index
  - **CDS-Cash Basis:** Difference between the CDS index and the CDS-mapped portfolio
- The CDS-Cash basis has been the primary driver of cumulative outperformance of the HY CDS indices

Cumulative Performance of Broad TE Sources

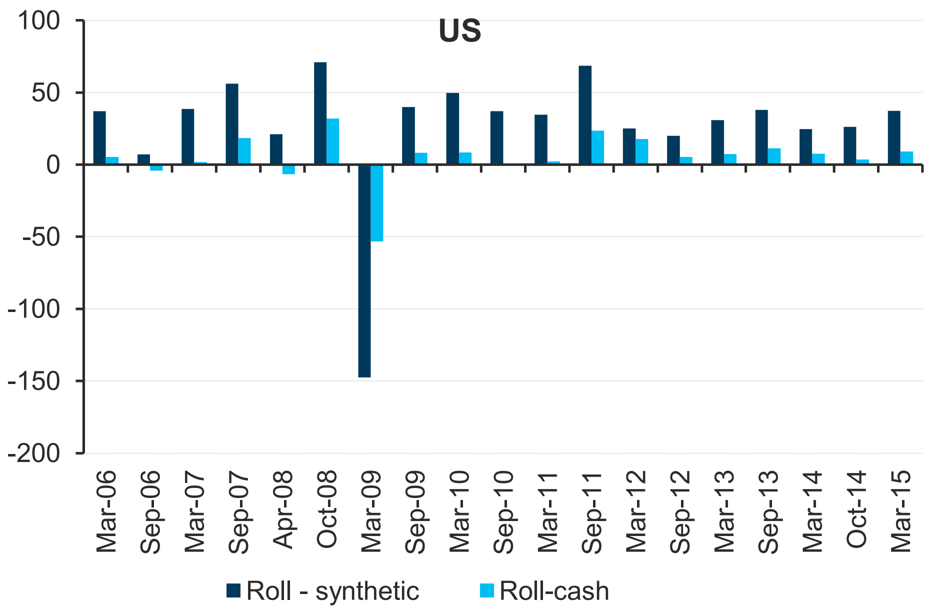


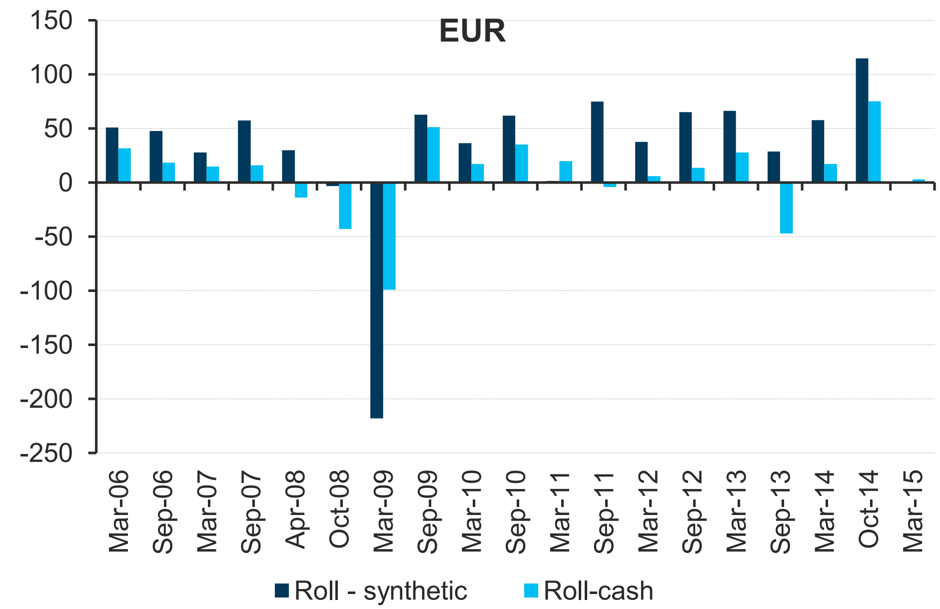
Sources: Bloomberg Barclays indices; Barclays Research

What explains CDS outperformance?

- **Basis carry?** - outperforms when average basis spread is positive (synthetic spread > bond portfolio spread)
  - But average basis spread close to zero => no outperformance from carry
- **Mark-to-market ?** – outperforms when basis spread contracts over the sample period
  - Does not explain basis outperformance of over 2%/yr
- **Index roll?** – The average CDS roll is significantly positive in all months and higher than the bond portfolio roll
  - Except during the financial crisis where the roll became negative

Series Roll (bp) – CDS HY Index vs. Issuer-mapped Bond Portfolio





Sources for all charts: Bloomberg Barclays indices; Barclays Research

Measuring and attributing index roll

- We split CDS index and corresponding bond roll spreads into allocation and curve effects

  - **Allocation:**
    - *For CDX:* Difference in intrinsic spreads[1] between the new and the old series
    - *For the Issuer mapped portfolio*: Difference in L-OAS between new and old series at 4.75y maturity

    - The allocation effect is positive if the CDS-cash basis of new issuers is higher than for existing issuers

  - **Curve:**
    - *For CDX*: Effect of maturity extension in CDS market
    - *For the Issuer mapped portfolio:* Difference in L-OAS between 5.25y and 4.75y maturities for the new series

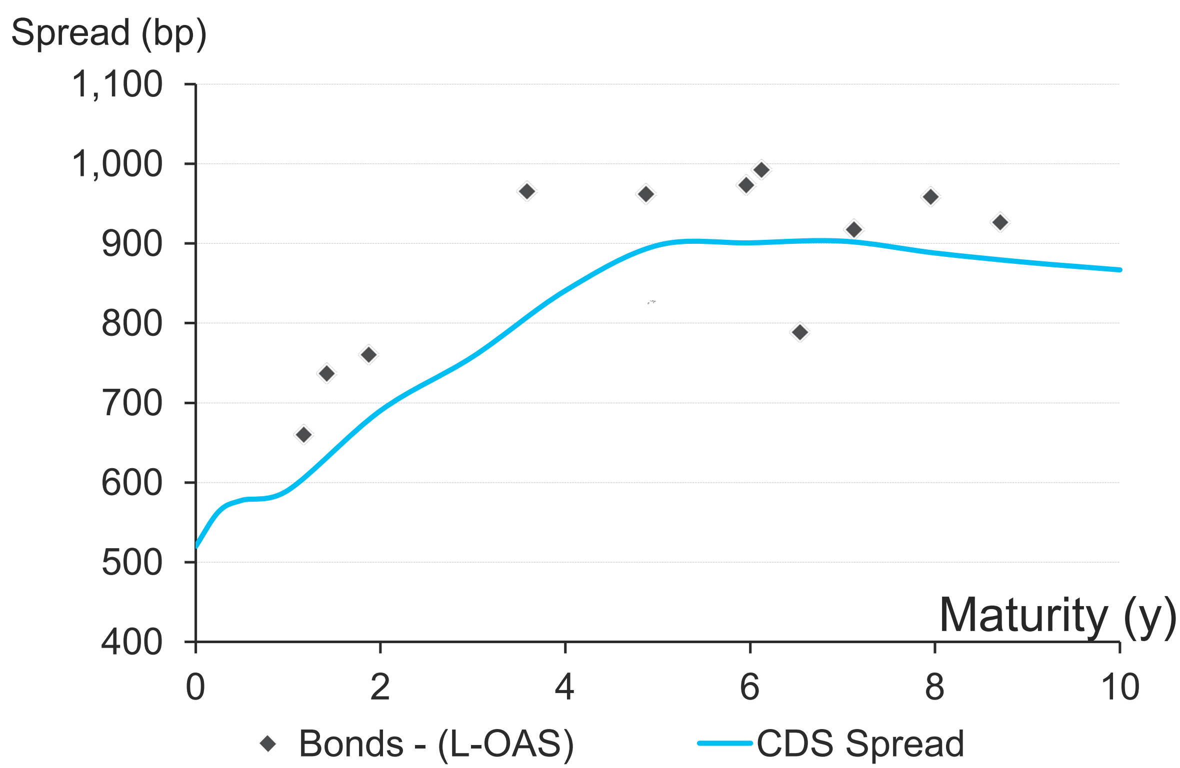
    - The curve effect is positive if the spread curve is steeper in CDS market than for corresponding bonds

Note: Intrinsic spreads calculated using underlying single name 5-year CDS spreads from Bloomberg

Comparing CDS and bond spread curves

- CDS curves are often steeper than bond curves especially in the 5 year segment
- Protection buyers may systematically roll into the on-the-run 5y contract making CDS curves steeper [1]
- Higher liquidity of cash bonds at the 5y issuance point may depress spreads making bond curves relatively flatter

Example Credit Curves – Sprint Bonds and CDS

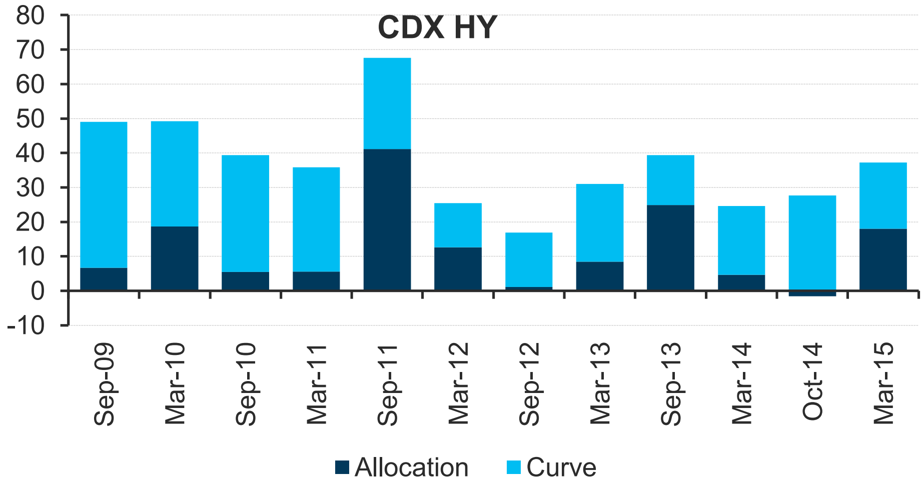


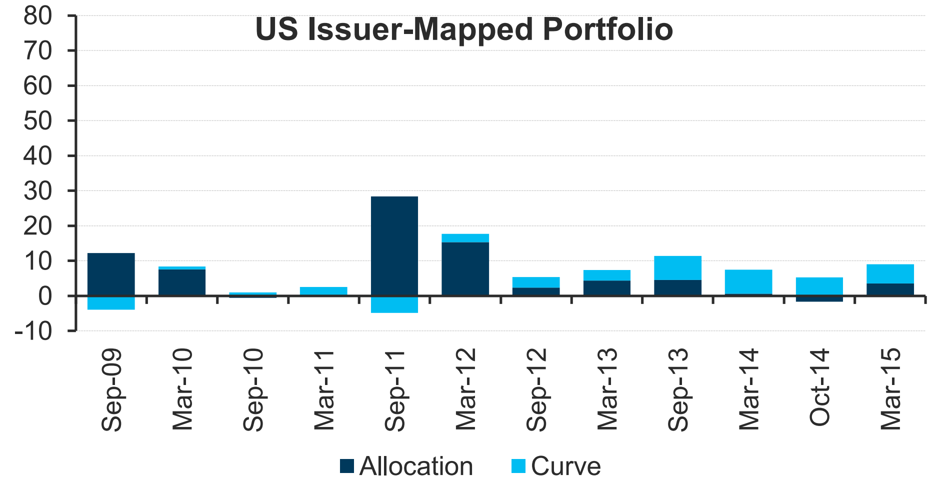
Sources: Bloomberg; Barclays Research

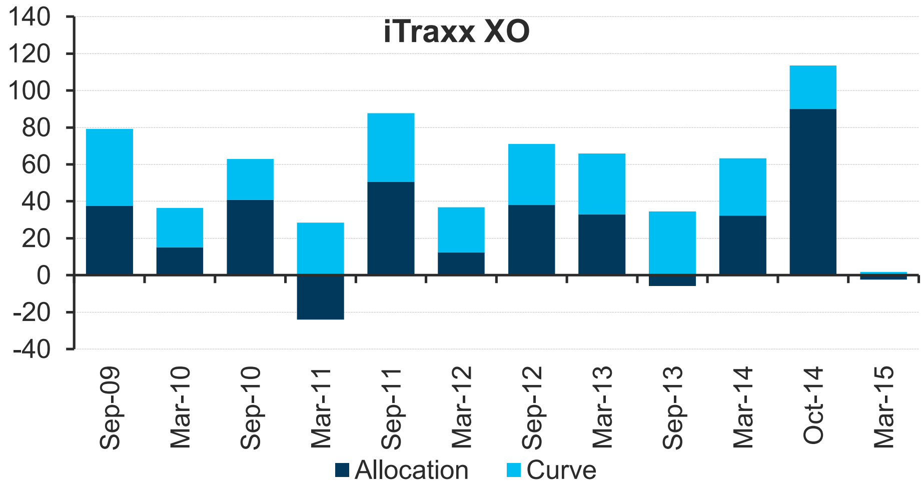
See European High Yield Credit: Crossover outperformance vs. bonds - past and future, 18 September 2015; Barclays Research

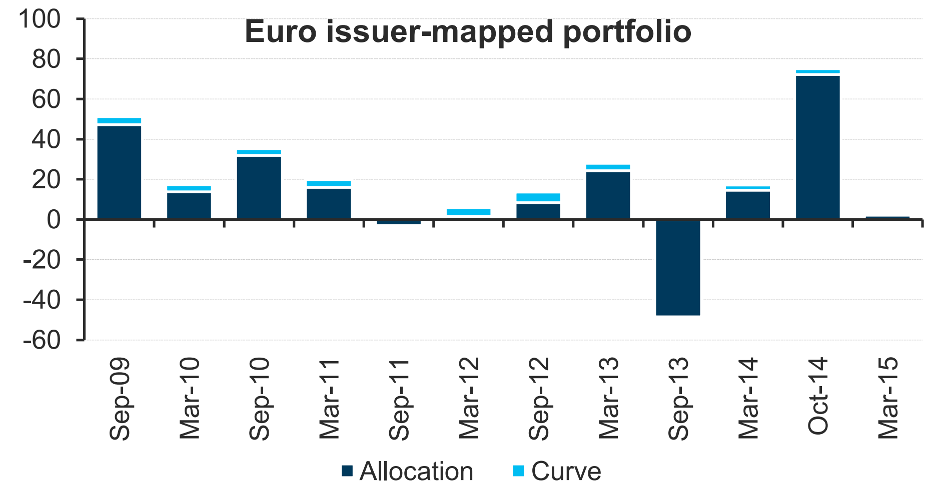
Attributing roll spread to allocation and curve effects

Spread curves are steeper for CDS than for bonds, leading to higher CDS roll









Sources for all charts: Bloomberg, Bloomberg Barclays indices; Barclays Research

Attributing return differences between CDS and bond indices

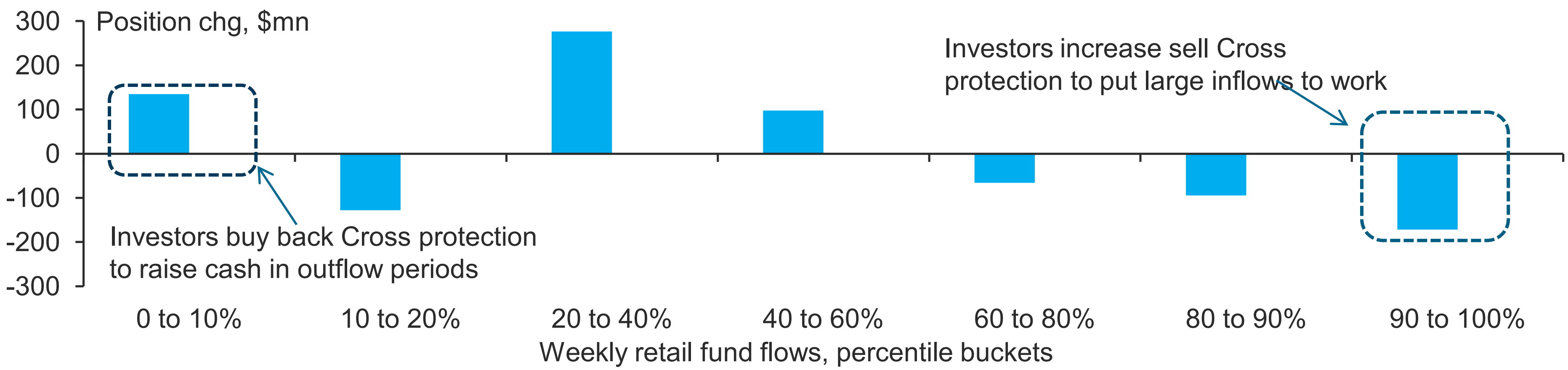
- Basis returns are decomposed into carry, MTM and index roll
  - Index roll is split into allocation and curve effects from Jan 2010
  - The curve effect, due to steeper synthetic credit curves, is the main driver of outperformance

	US		Europe	
(%/y)	2006-2015	2010-2015	2006-2015	2010-2015
HY Bond Index excess return over swaps	3.5	4.7	5.0	6.5
+ Composition effect	0.3	0.5	-0.7	-0.4
= Matched bond portfolio	3.8	5.2	4.4	6.1
+ Basis (= MTM + Index Roll + Basis Carry)	2.0	2.3	3.3	3.3
MTM effects	-0.1	0.1	1.1	0.4
Index Roll (= Composition + Curve)	***1.8***	***2.1***	***2.1***	***2.7***
Allocation	-	0.5	-	1.0
Curve	***-***	***1.6***	***-***	***1.8***
Basis Carry	0.3	0.1	0.0	0.1
= Synthetic index unfunded return	5.8	7.4	7.6	9.4

Source: Bloomberg Barclays indices; Barclays Research

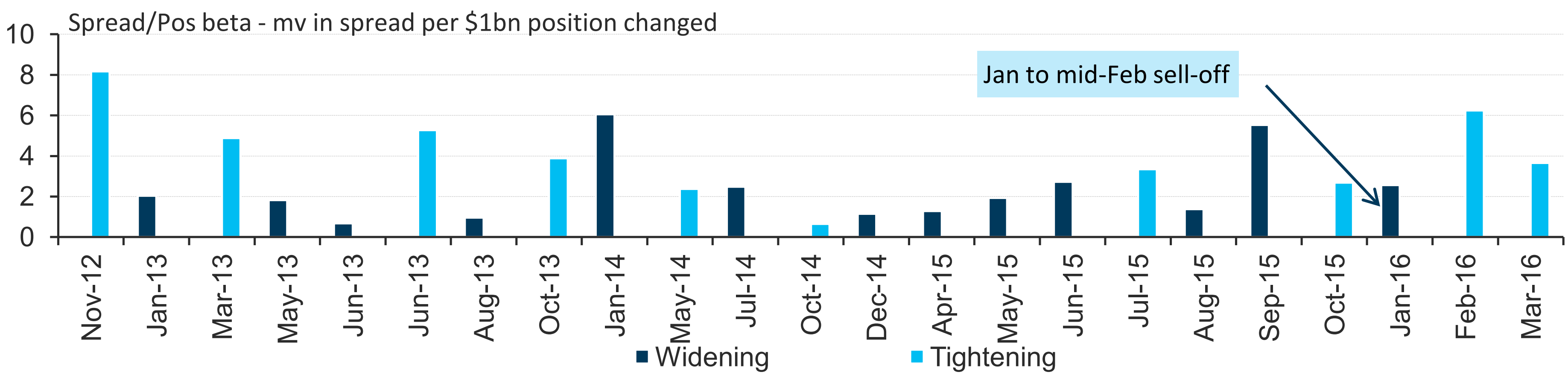
Negative CDS-cash basis: the macro view – 1

HY funds use CDS indices as liquid place holder for cash



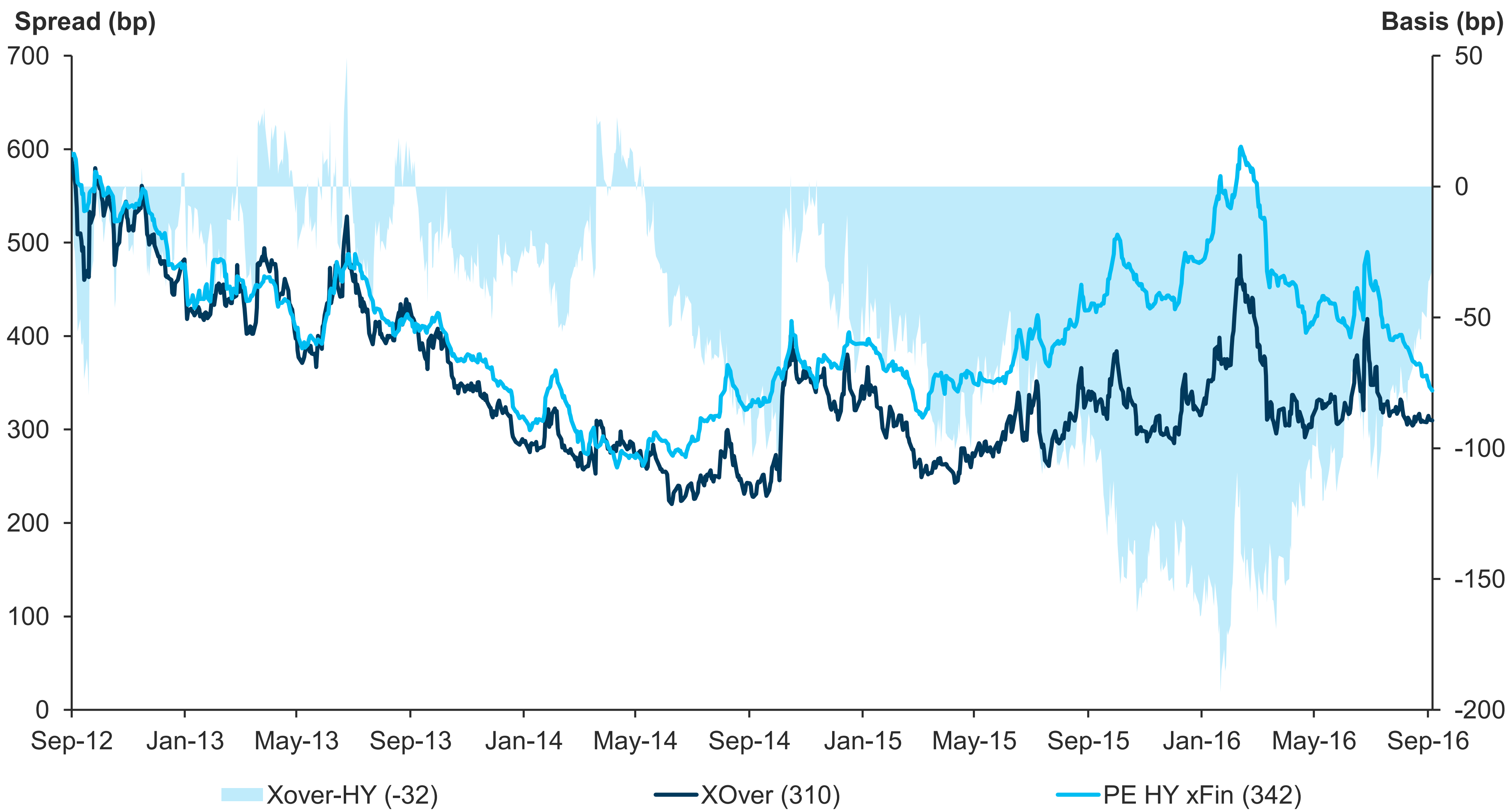
Source: DTCC, Barclays Research.

CDS indices efficiently transmit risk in sell-offs (iTraxx Main shown)



Source: DTCC, Barclays Research

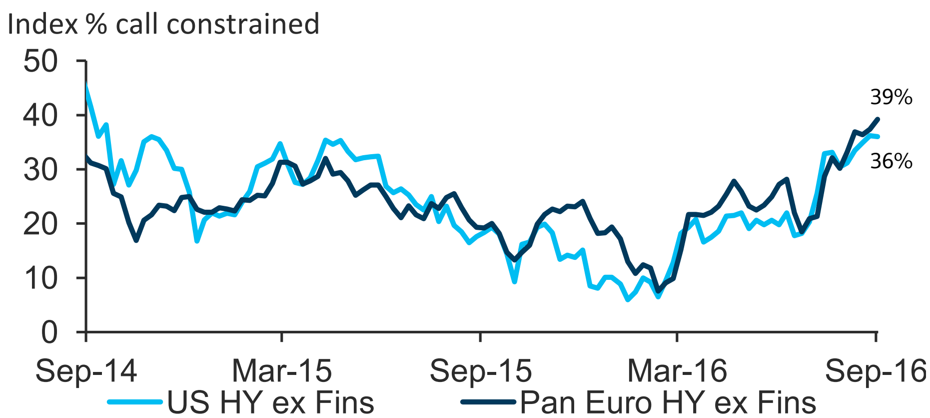
Negative CDS-cash basis: CDS-cash basis – macro view – 2



Source: Bloomberg, Barclays Research

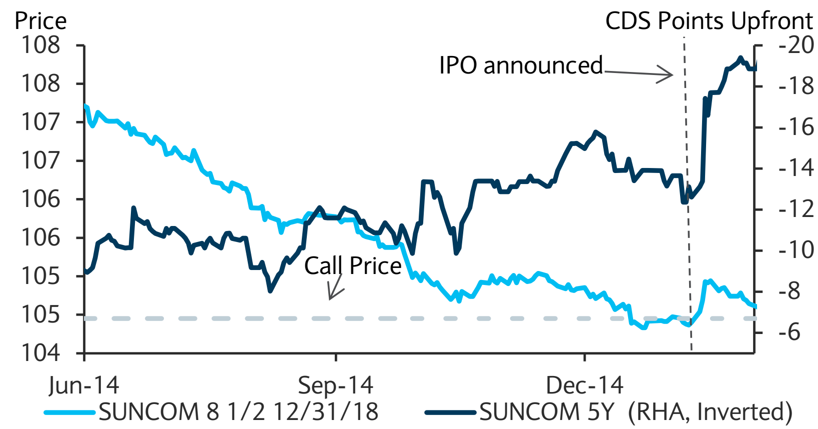
Negative CDS-cash basis: the micro view

Pct of call-constrained



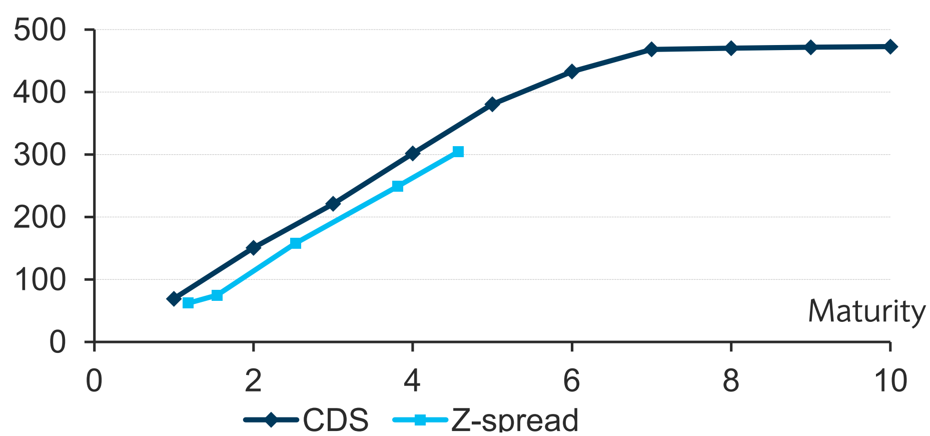
Source: Bloomberg, Barclays Research

Upside in call-constrained names



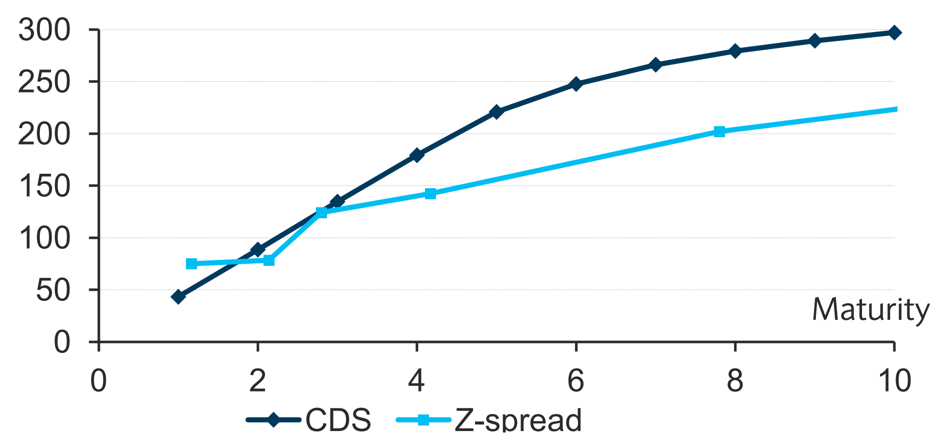
Source: Bloomberg, Barclays Research

MTNA – CDS vs cash



Source: Bloomberg, Barclays Research

TSCOLN – CDS vs cash



Source: Bloomberg, Barclays Research

Hedging HY Portfolios

HY bonds exhibit equity-like tail risk but hedging is challenging

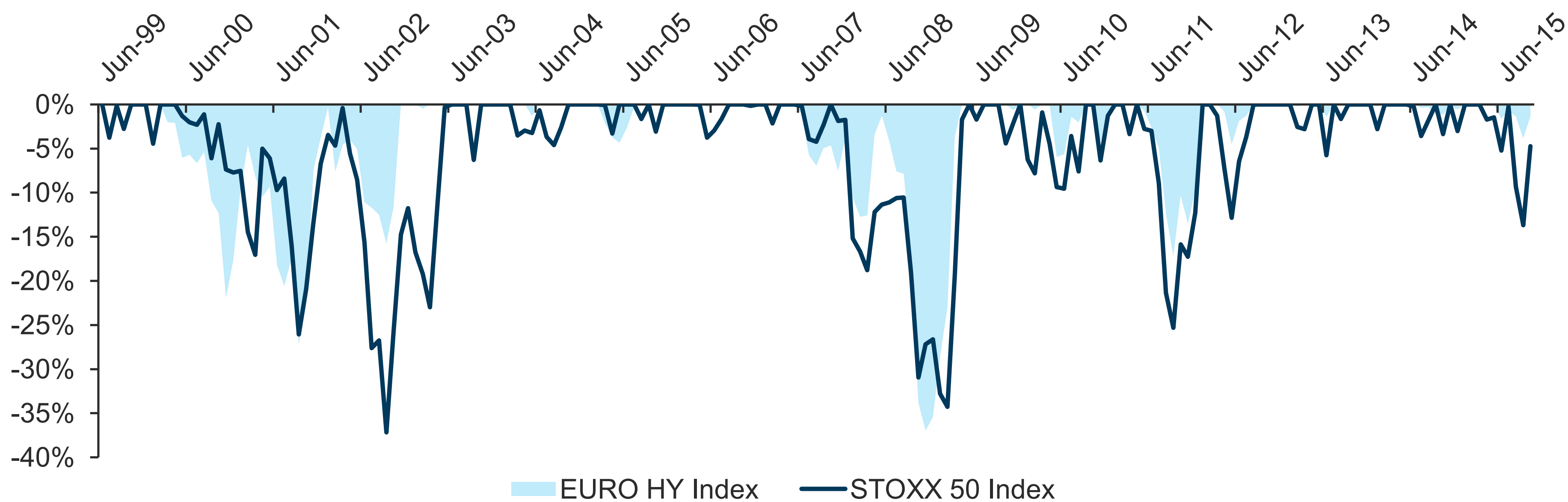
X Option 1: Scaling portfolio positions. Costly due to illiquidity

X Option 2: Shorting HY ETFs. Costly and lacks capacity

V Option 3: HY CDX

V Option 4: Equity instruments?

Euro HY vs. EuroStoxx50: Trailing 6-month Drawdown



Note: Drawdown is calculated from excess returns of Bloomberg Barclays EUR HY bond index and returns of Eurostoxx50 index.
Sources: Bloomberg; Bloomberg Barclays indices; Barclays Research

Descriptive statistics: indices and hedging instruments

- Do CDX/futures hedge equally well given similar correlation with index (but different tail properties) ?

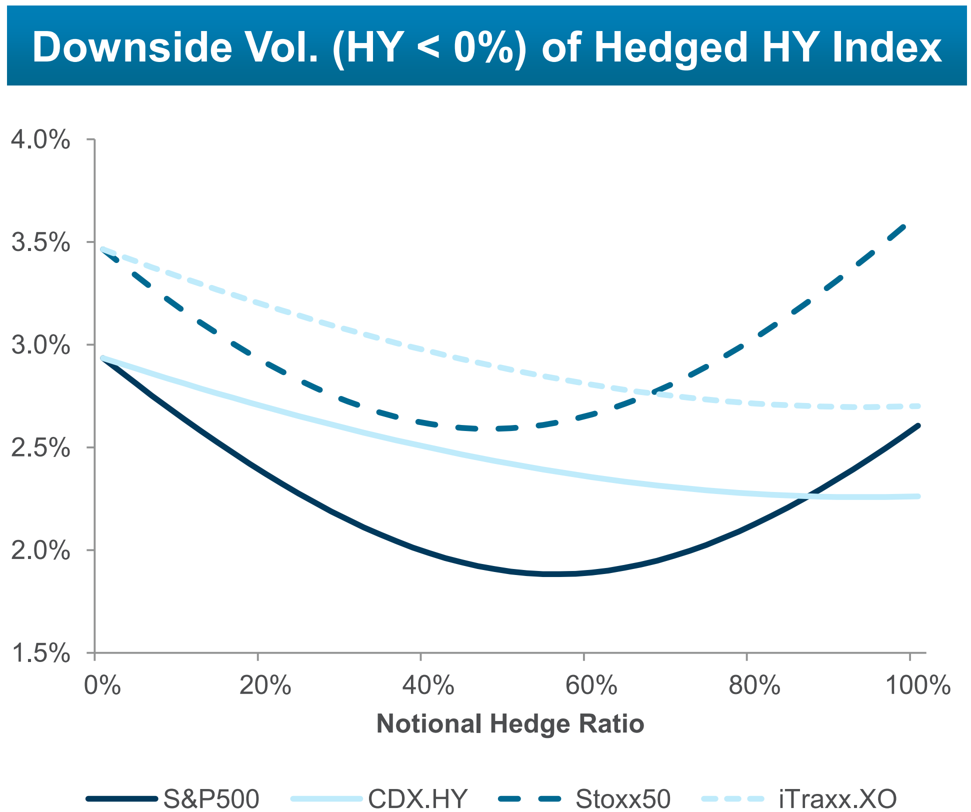
	US			Euro		
	US HY	CDX.HY	S&P500 Futures	Euro HY	iTraxx.XO	Stoxx 50 Futures
Avg. Ret (%/m)	0.65%	0.49%	0.58%	0.69%	0.61%	0.37%
Volatility (%/m)	2.9%	2.6%	4.2%	3.5%	2.5%	5.3%
Max. Drawdown	-33.3%	-24.9%	-53.3%	-37.6%	-19.6%	-57.1%
VaR 95%	-3.2%	-4.0%	-7.2%	-4.5%	-3.6%	-9.1%
Worst Month	-15.9%	-6.5%	-17.3%	-17.9%	-7.4%	-15.3%
Beta to index	1.00	0.67	1.06	1.00	0.53	1.01
Correlation w index	1.00	0.75	0.73	1.00	0.74	0.67

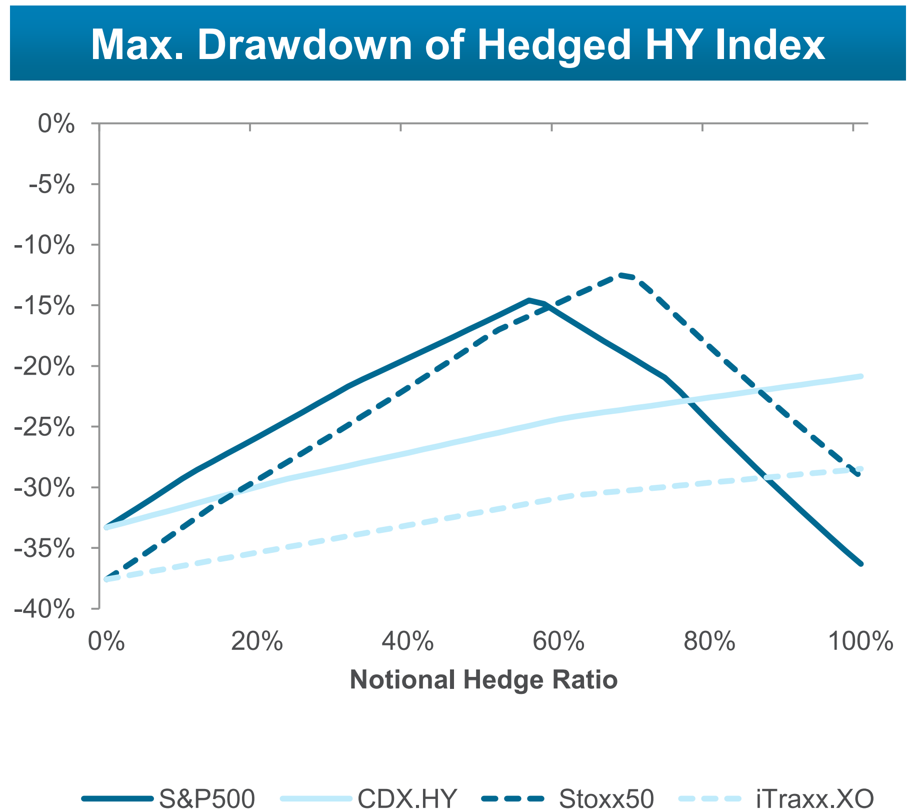
Notes:
Period: Sep 2004 to Oct 2015 for the US market and Sep 2005 to Oct 2015 for the Euro market
HY returns are the total returns from Barclays U.S. High Yield Index. CDX unfunded return is the unfunded return of Barclays U.S. High Yield CDX on-the-run, SPX is the traded 3-month future on S&P 500 index,

Sources: Bloomberg; Bloomberg Barclays indices; Barclays Research

Equity instruments are more effective than CDS indices

- Equity futures hedge more effectively volatility (but over-hedging beyond 58% (US) or 54% (EUR)
- Equity futures are more effective for tail risk measures





Note: Downside volatility is calculated using returns in months in which the HY index had negative returns.
Sources for all charts: Bloomberg; Bloomberg Barclays indices; Barclays Research

Performance of hedging instruments depends on market state

- How did the hedging instruments perform under '**good' or 'bad' market conditions**?
  - **Ex-Post (HY Index total return)**: positive vs. negative
  - **Ex-Ante (HY Index spread widening):** last month spread widened > 1 stdev
- Equity futures had higher correlation and beta to the bond index in 'bad' market state than CDS indices
- Similar pattern observed in the US market

Performance by HY Return State (Euro)

	High Yield Index	Credit Defualt Swaps	Equity Futures	High Yield Index	Credit Defualt Swaps	Equity Futures
	Euro	*iTraxx.XO*	*Stoxx 50*	*Euro*	*iTraxx.XO*	*Stoxx 50*
HY Index Return (contemporaneous)		<u>Negative</u>			<u>Positive</u>	
Avg. Ret (%/mo)	-2.74%	-1.68%	-4.52%	2.06%	1.53%	2.33%
Volatility (%/mo)	3.46%	2.33%	4.85%	2.42%	1.92%	4.06%
Correlation with HY Index	1.00	0.63	0.66	1.00	0.58	0.35
Beta to HY Index	1.00	0.42	0.93	1.00	0.46	0.59
Spread Change (ex-ante)		<u>Spread Widening > 1 Std</u>			<u>Other</u>	
Avg. Ret (%/mo)	-0.78%	0.04%	-0.81%	1.03%	0.74%	0.64%
Volatility (%/mo)	4.81%	3.50%	6.66%	3.06%	2.22%	4.92%
Correlation with HY Index	1.00	0.79	0.84	1.00	0.71	0.58
Beta to HY Index	1.00	0.58	1.17	1.00	0.52	0.93

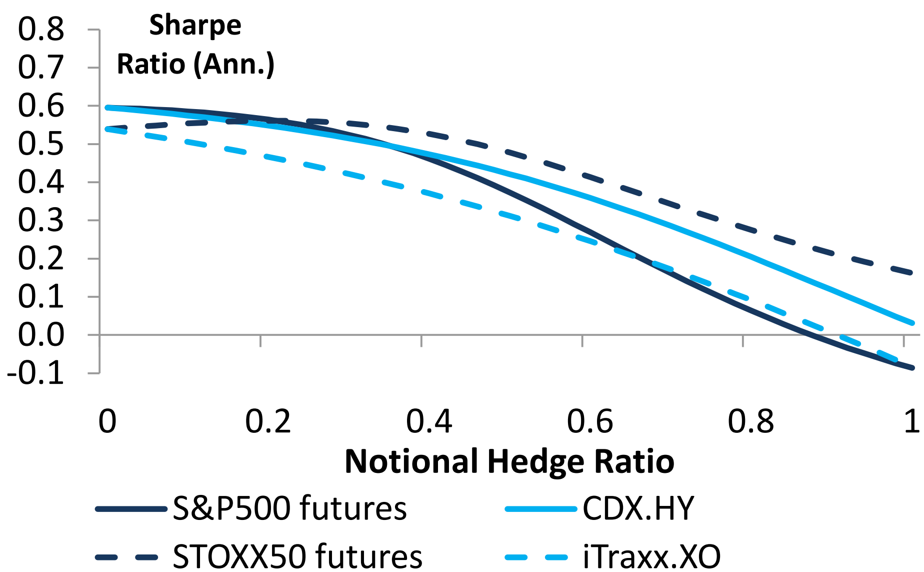
Sources: Bloomberg; Bloomberg Barclays indices; Barclays Research

Hedging unconditionally may be too costly

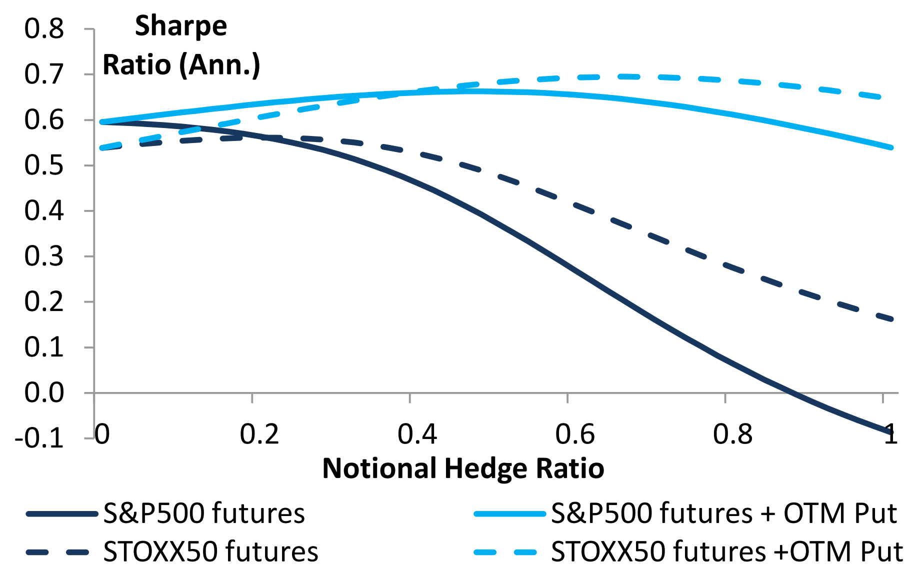
- Unconditional hedging typically reduced the S.R. due to lower returns
- Hedging with equity futures hurts performance during equity bull markets
- "Writing" OTM short-maturity put options on the underlying equity index helps reduce hedging cost
  - Put Overlay: Strike prices = 95% of spot-level indices, 3 months to maturity, rolled on a monthly basis

Sharpe Ratio of Hedged HY Index

Futures vs. Credit Default Swaps



Futures Only vs. Futures + OTM Put Options

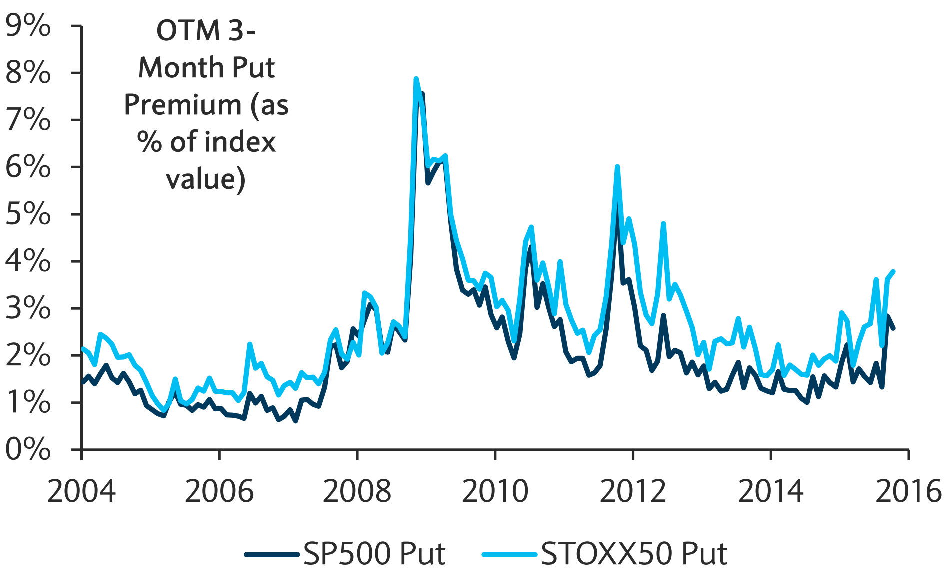


Sources for all charts: Bloomberg; Bloomberg Barclays indices; Barclays Research

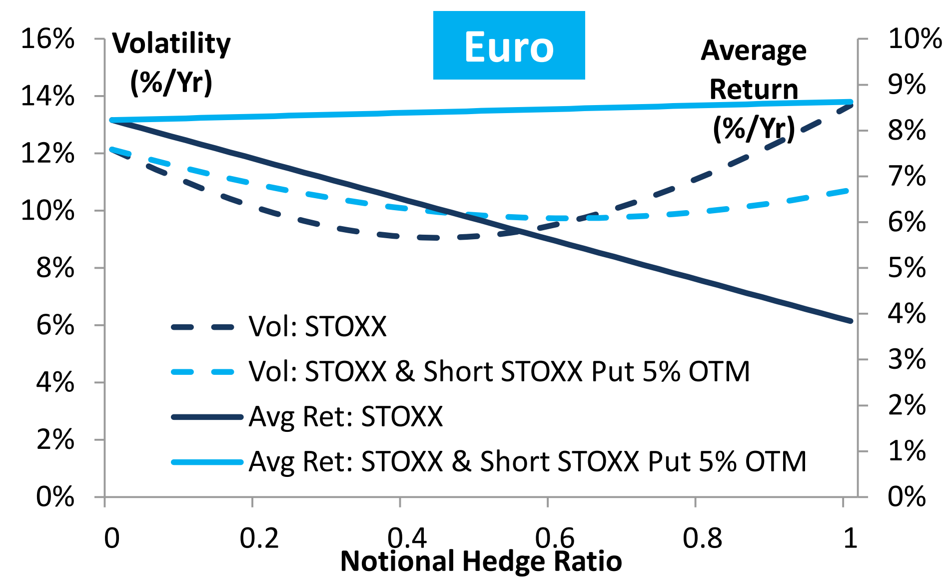
Selling puts on equity indices generates returns

- The premiums collected from writing OTM Put options are considerable with an average of 2.67% (Euro) and 2.11% (US)
- 'Writing' OTM put option may increase the hedging benefits because put return may offset equity returns uncorrelated with HY returns

SP500 and Stoxx 50 Put Option Premiums



Return and Vol with OTM Put Writing

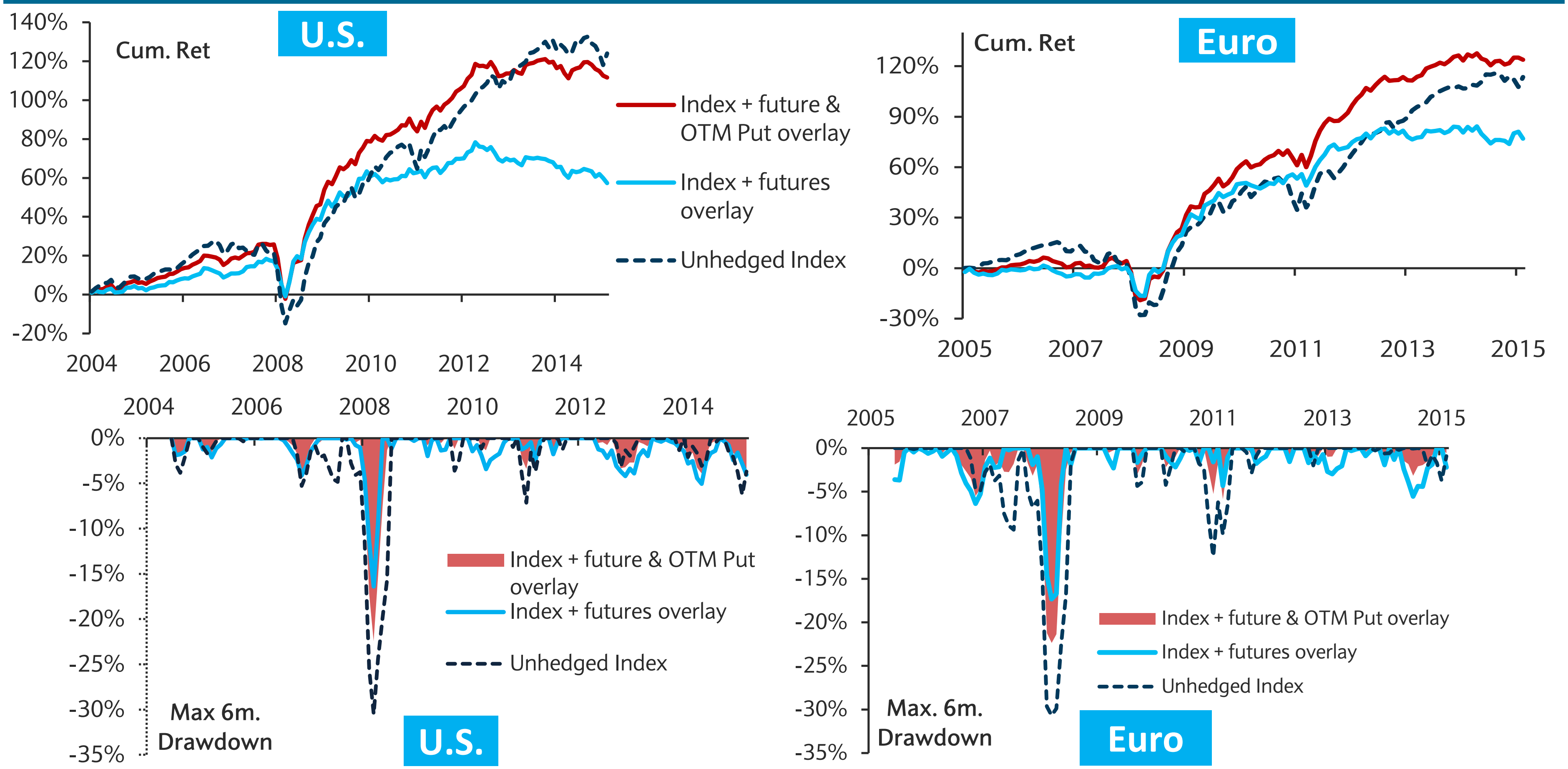


Sources for all charts: Bloomberg; Bloomberg Barclays indices; Barclays Research

Hedging with Futures + Put overlay performed well

- Similar, and sometimes higher, cumulative performance than the unhedged index
- Lower drawdowns over most six-month periods than the unhedged index

Cumulative Performance and Drawdown with Equity Overlays (50% Hedge Ratio)



Sources for all charts: Bloomberg; Bloomberg Barclays indices; Barclays Research

Effect of skill on the performance of hedged HY index

- We use the notion of skill to represent a PM making active hedging decisions. Skill reflects the prob. of making correct directional calls on the return of the HY Index
  - 0% skill = 50/50 random pick. 100% skill = always making a correct call. Any other skill level is a linear interpolation of the two
  - Hedge months when the HY index return is expected to be negative and do not hedge otherwise
- It requires skills above 40% for hedging with iTraxx.XO to have better return and S.R. than the unhedged index
- Hedging with equity futures outperformed iTraxx.XO with low skill, and with no skill if writing Put options

Performance of Hedged Indices by Overlay Type and Skill Level (Euro)

		Avg. Ret (%/mo)			Volatility (%/mo)			Sharpe Ratio		
Euro HY Bond Index (unhedged)		0.69			3.50			0.54		
Euro HY Bond Index hedged with										
Skill Level	Prob. Of 'correct' call	**Credit Default Swaps**	**Futures**	**Futures + Option**	**Credit Default Swaps**	**Futures**	**Futures + Option**	**Credit Default Swaps**	**Futures**	**Futures + Option**
0%	50%	0.38	0.50	0.70	2.99	3.73	2.83	0.29	0.34	0.69
20%	60%	0.54	0.80	0.87	2.98	3.61	2.74	0.47	0.64	0.93
40%	70%	0.70	1.09	1.03	2.97	3.47	2.68	0.66	0.96	1.16
60%	80%	0.85	1.39	1.20	2.94	3.29	2.65	0.85	1.32	1.40
80%	90%	1.01	1.69	1.37	2.91	3.07	2.65	1.04	1.75	1.61
100%	100%	1.17	1.98	1.53	2.87	2.81	2.68	1.25	2.28	1.81

Sources: Bloomberg; Bloomberg Barclays indices; Barclays Research

Signal from spread can be useful for active hedging

- Due to illiquidity, price adjusts gradually leading to predictability
- A synthetic overlay can be deployed to exploit this predictability quickly and cheaply
  - Hedge if OASt-1 >1Std
  - The overall success rate (69% U.S., 70% Euro) were higher than a 50-50% random chance
- The signal is more successful in up markets with a success rate of 86% (26% in down)
- Overall success rate is equivalent to skill of 37% (US) and 41% (Euro) and lower if up and down months were equally likely (12% for US 18% for Euro)

Relation between Spread Signal and High Yield Market Behavior

		U.S.			Euro		
		Ret. <0	Ret. >=0	Overall	Ret. <0	Ret. >=0	Overall
Total		39	95	134	35	87	122
signal (months)	'Hedge'	10	13	23	11	12	23
	'Don't Hedge'	29	82	111	24	75	99
Prob. Conditional on Ret. Realization	Correct call	26%	86%	69%	31%	86%	70%
	Incorrect call	74%	14%	31%	69%	14%	30%
'Skill' equivalent			37%			41%	
'Skill' with equal 'up' and 'down' months			12%			18%	

Sources : Bloomberg; Bloomberg Barclays indices; Barclays Research

Active hedging with a spread signal improves S.R.

- Futures + OTM options overlay dominated the other overlays with full hedging
  - Generated higher returns, Sharpe Ratio, and Inf. Ratio
  - S.R. corresponds to a skill level of 10% (US) and 15% (Euro)
- Using credit swaps overlay led to lower returns but better S.R. than the unhedged index

Performance of Active Overlay Strategy with Spread Signal

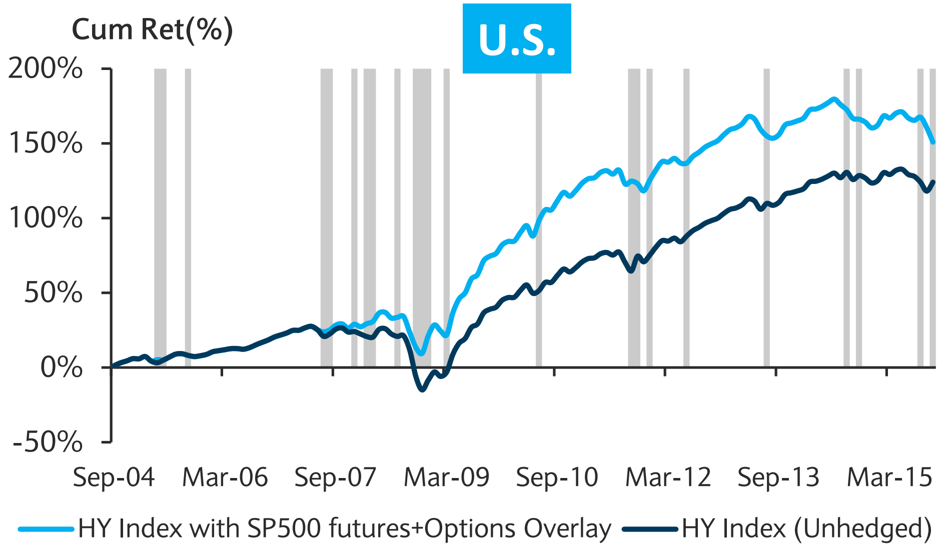
		Full Hedging (HR = 1)		
	High Yield Index	Credit Default Swaps	Equity Futures	Equity Futures + OTM Put
U.S.		**CDX.HY**	**SP500**	**SP500**
Avg. Ret (%/mo)	0.65%	0.60%	0.68%	0.72%
Volatility (%/mo)	2.90%	2.45%	2.54%	2.55%
Sharpe Ratio	0.60	0.65	0.73	0.78
Inf. Ratio (Hedged-Unhedged)		-0.10	0.04	0.16
Euro		**iTraxx.XO**	**Stoxx50**	**Stoxx50**
Avg. Ret (%/mo)	0.69%	0.68%	0.84%	0.89%
Volatility (%/mo)	3.50%	3.11%	3.19%	3.07%
Sharpe Ratio	0.54	0.60	0.76	0.85
Inf. Ratio (Hedged-Unhedged)		-0.02	0.19	0.42

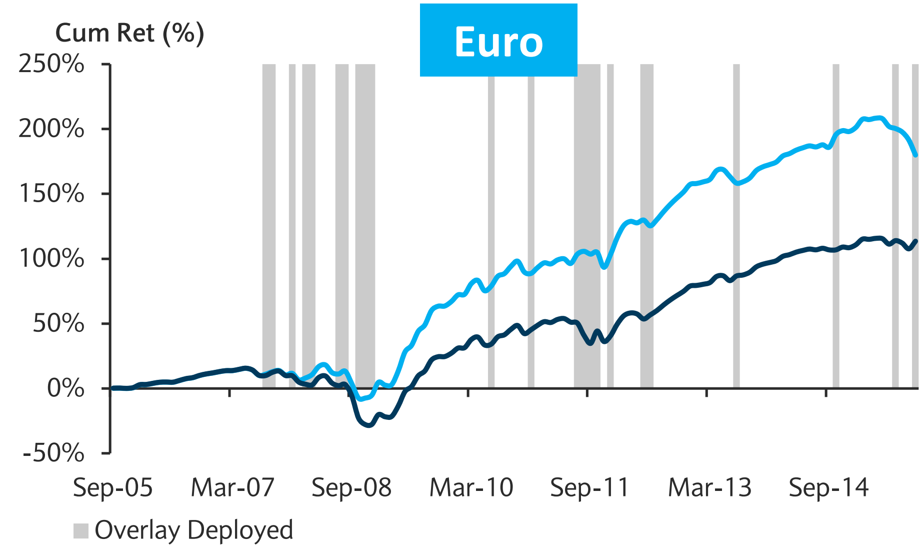
Sources : Bloomberg; Bloomberg Barclays indices; Barclays Research

Steady Outperformance from Futures + Option using Spread Signal

- Based on the spread signal, the futures + OTM options overlay were deployed multiple times during the financial crisis in 2007-2009 and afterwards
- Dynamic deployment generated steady outperformance to the unhedged HY index
- US and Euro markets are highly correlated in terms of in hedged returns (0.91) and hedging signal (0.67)

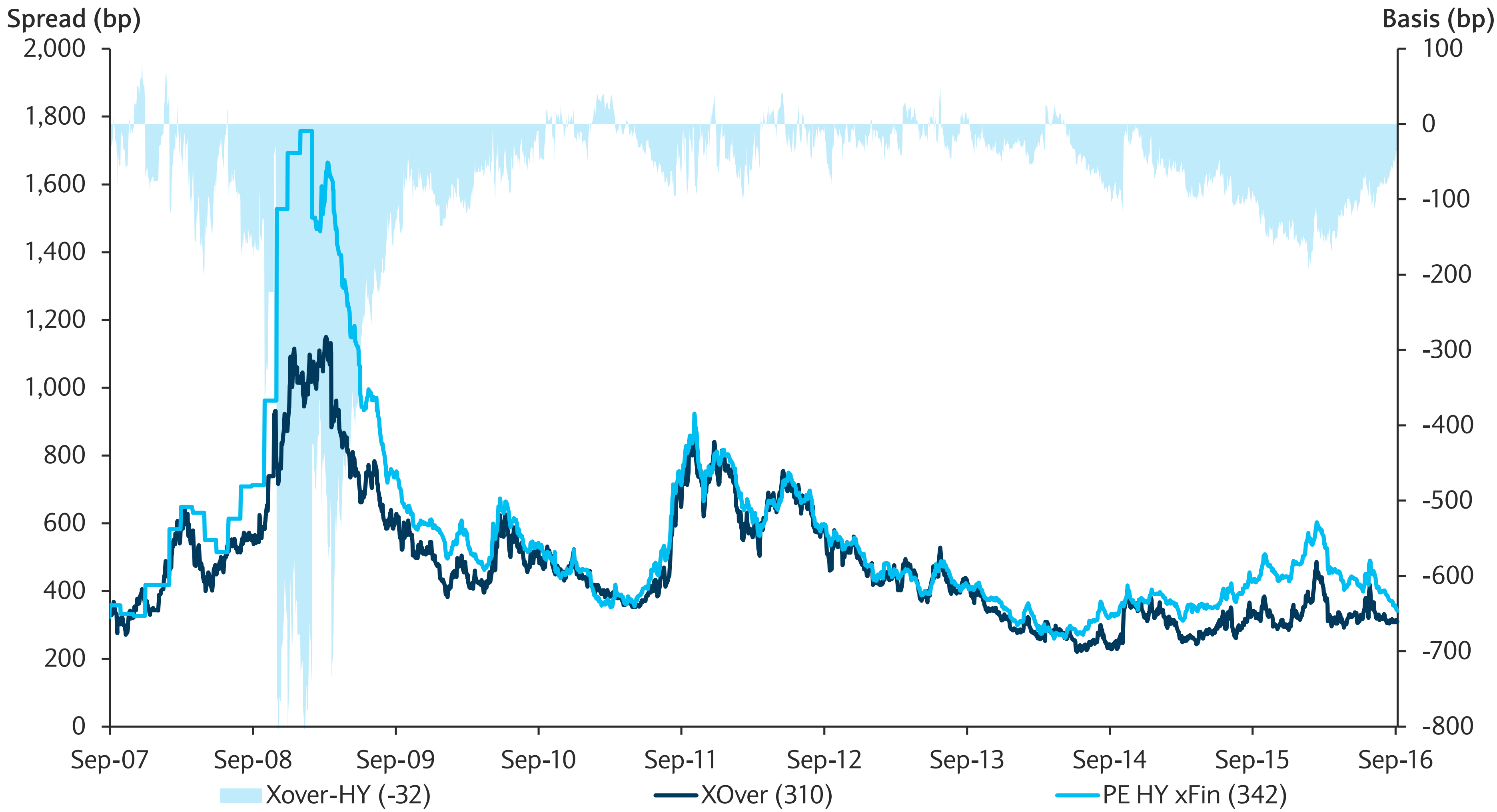
Cumulative Performance with an Active Overlay based on Spread Signal





Sources for all charts: Bloomberg; Bloomberg Barclays indices; Barclays Research

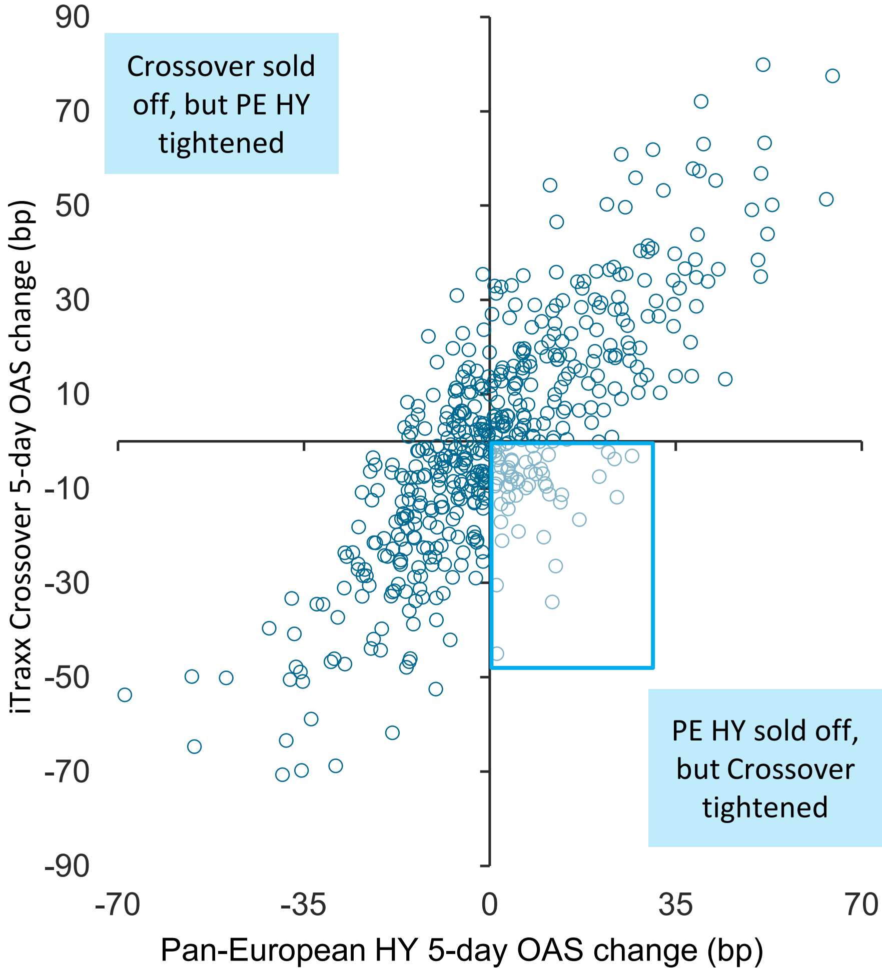
CDS-cash basis – history rhymes or repeats?



Source: Bloomberg, Barclays Research

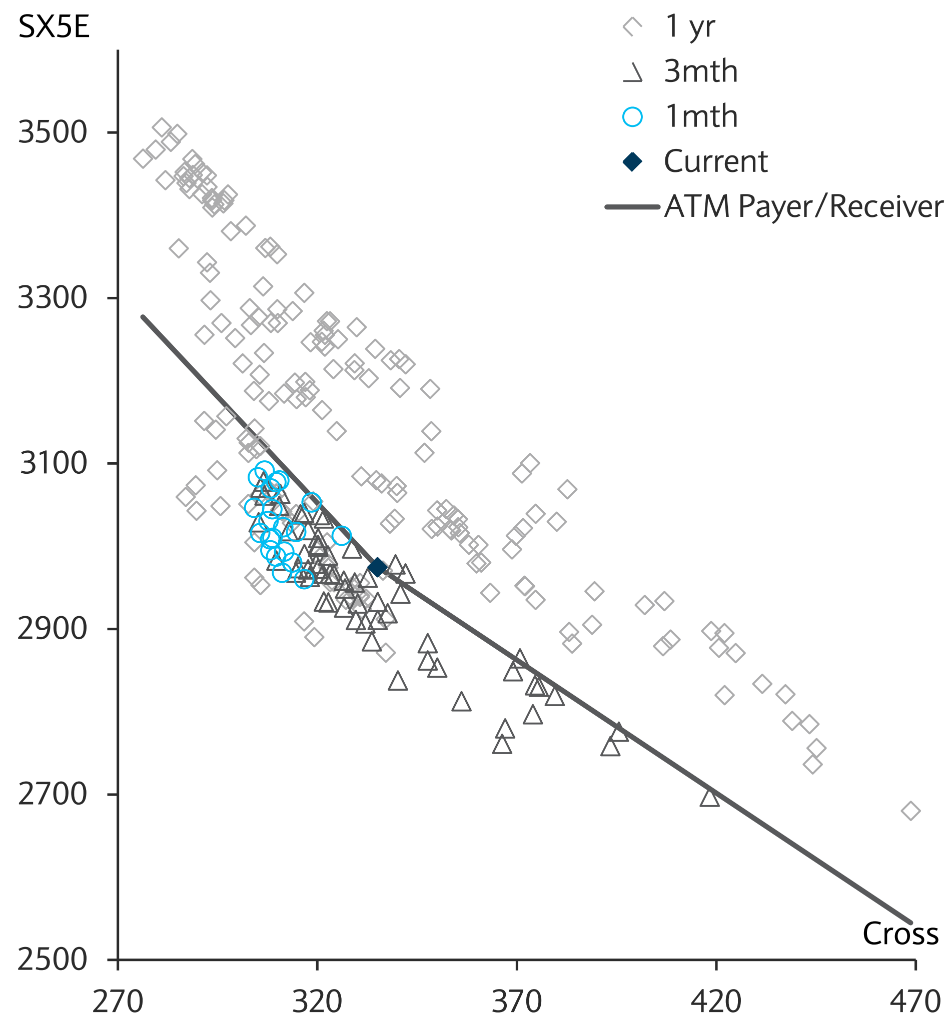
Cross – risk of hedge misfiring and SX5E as an alternative

Legitimate risk of Cross hedge misfiring



Note: 2 years of data, weekly change, PEHY vs iTraxx Crossover. Source: Bloomberg, Barclays Research

Cross options not expensive vs SX5E

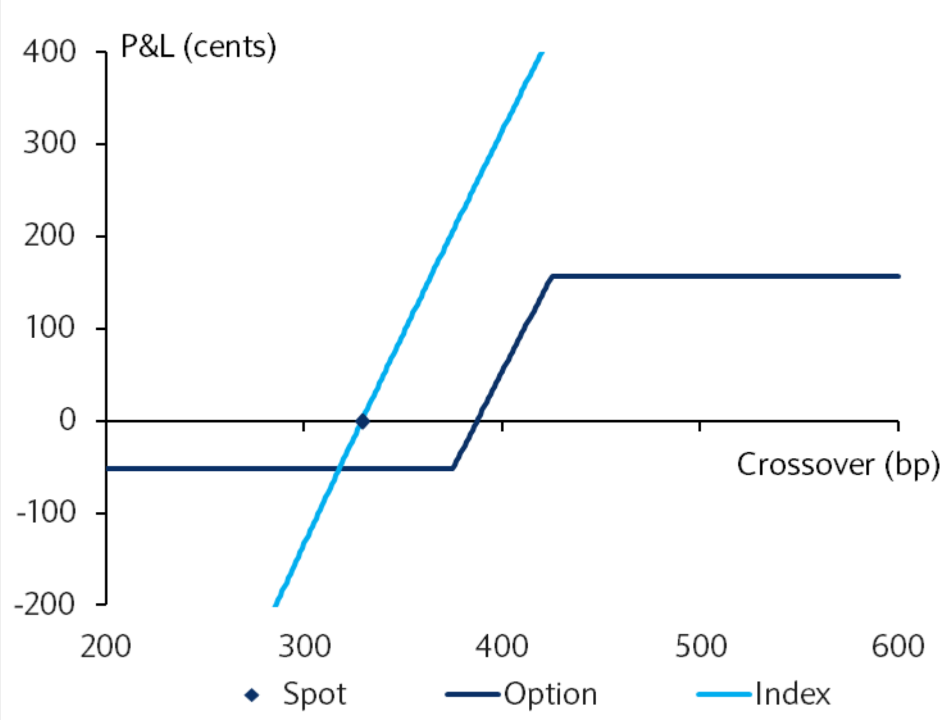


Note: 1 years of data. Source: Bloomberg, Barclays Research

Examples for index option trade structures

Worried about downside? Payer spreads

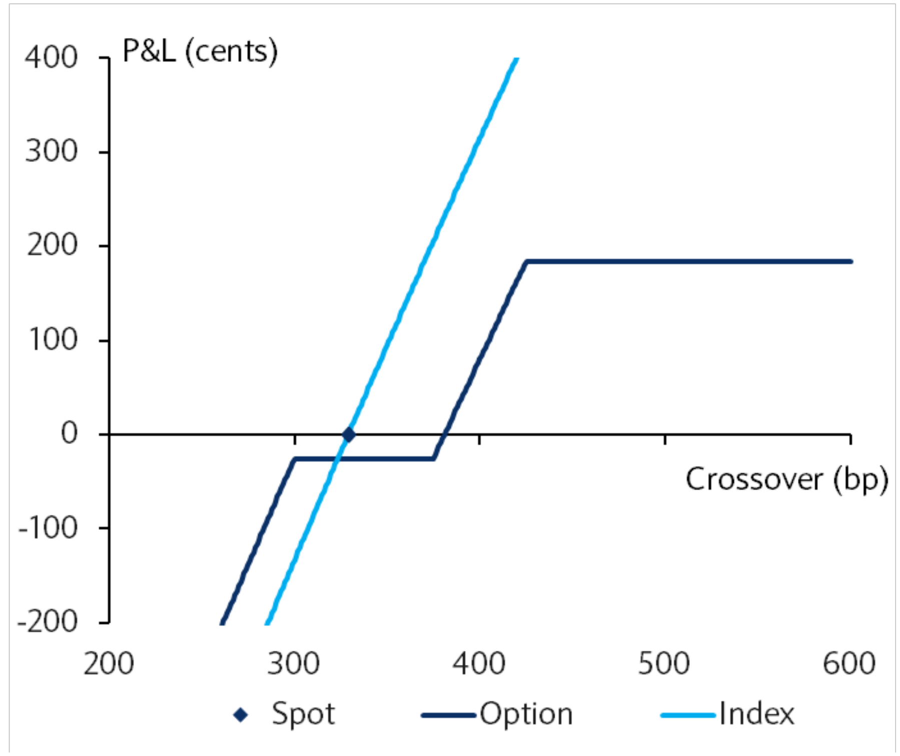
- Payer spread example:
  Buy K375 Payer @83.9, Sell K425 Payer @31.8
- Total cost of 52.1cts – similar to index carry from now to option expiry



Illustrative examples using market prices from 14 September 2016. Note: November expiry, ref 329. Source: Barclays Research

Bearish seagulls are hovering above

- Seagull example:
  Sell K300 Receiver @26.8, Buy K375 Payer @83.9, Sell K425 Payer @31.8
- Total cost of 25.3cts



Illustrative examples using market prices from 14 September 2016. Note: November expiry, ref 329. Source: Barclays Research

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