

# Hedging the tail

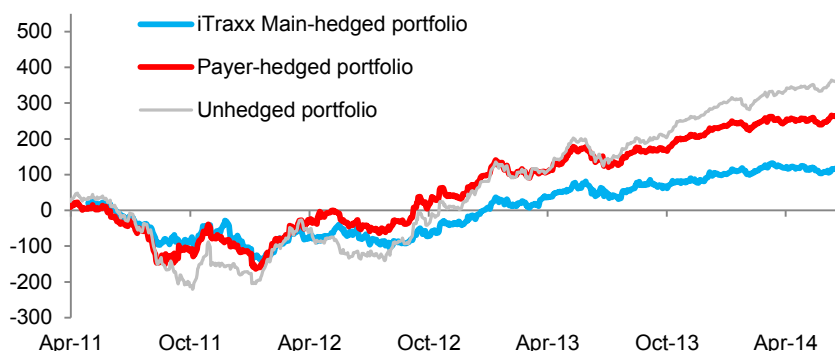
## Why real money should consider all options

- **Less downside, more upside** – Using a portfolio benchmarked to iBoxx, we demonstrate how cumulative performance since 2011 could have been improved by 150bp by using options instead of a conventional iTraxx Main hedge.
- **It doesn't need to be all that complicated** – As illustrated in Figure 1, this is possible with little additional downside during selloffs and using only a simple payer strategy. This note is not a Greeks festival, we promise!
- **A radical transformation** – While some real money accounts are already using options actively, many remain sceptical. Investors often underestimate the sizes that can now be transacted and therefore dismiss it for risk management purposes. But with growth in volumes, liquidity has developed and tickets in excess of a billion euros are now traded regularly.
- **Any better alternatives?** – Option strategies aren't a free lunch. Nor are they a perfect hedge. Conventional alternatives like the CDS indices, tranches or various equity derivatives all have drawbacks of their own. Against these, we believe credit options can offer an efficient way of limiting downside risks to a credit portfolio while retaining performance potential, at a time where concerns about the ultimate sustainability of valuations seem to be mounting.

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Figure 1. Cumulative portfolio performance, Jun-11 – Jun-14



Source: Citi Research, MarkIt

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

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## Why real money should consider all options

This is not a primer on options<sup>1</sup>. This is an attempt to convince real money investors that, if options aren't part of your portfolio strategy, then they should be.

This note focuses on options as a portfolio *hedging* tool. We argue that options allow you to hedge downside risk more efficiently than the iTraxx indices themselves. Obviously, options can also be used to add upside to a portfolio. In an upcoming piece, we also plan to illustrate that options can be a more attractive way of adding beta than, say, adding more subordination, reducing credit quality or taking more spread duration.

Our principal finding is that **a simple payer strategy could have cut the 95<sup>th</sup>-percentile loss on the 3-month excess return of a portfolio in half, but retained almost three-quarters of the cumulative excess return over the last three years**. Hedging with iTraxx Main instead would only have lowered the 95<sup>th</sup>-percentile loss marginally from that, but would have eliminated two-thirds of the excess return.

What if your mandate doesn't allow you to buy/sell options? We reckon that you need to start following the market regardless, even if just to know what your peers are doing. The volumes traded are now so large that they periodically impact spreads on the underlying CDS indices – sometimes the tail is now wagging the dog, so to speak.

### Case study: Hedging a cash portfolio with credit options

In credit it is usually pretty difficult to make the return target without being long – outright or relative to benchmark. We'd all like to claim that our particular brand of alpha generation can do it. But the reality is that it is difficult, if not impossible, to get there without taking beta, especially now that the dispersion between credits in the European IG credit is near an all-time low (Figure 2).

Yet that reliance on beta sits uncomfortably with the lingering sense here that valuations are already stretched, in a world where many macro risks still linger longer term. For many portfolio managers, striking the balance between the need to perform in the short term, and longer-term sustainability concerns, seems to be the Holy Grail at the moment.

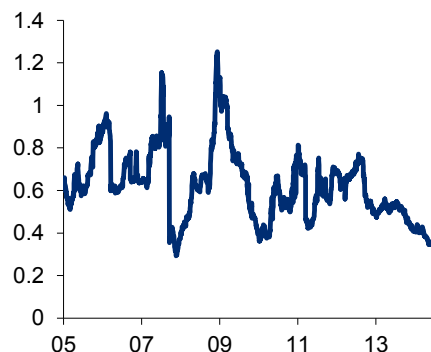
So how do you best hedge yourself without giving up the carry on the portfolio?

#### The portfolio

We will work with a portfolio benchmarked against the iBoxx € Corporate index, where current holdings deviate as indicated in Figure 3. The portfolio generates excess carry of 45bp, which along with our assumption that the iBoxx index ends the year at 80bp would imply an excess return for the next year of about 66bp<sup>2</sup> – we think that's a reasonable estimate of what many funds would target ex ante at a minimum.

For simplicity, we have assumed that the portfolio is neutral on spread duration and neutral on subordination (beyond what's implied by the BBB/HY overweight). The beta of the portfolio to the index in levels over the last six months is 1.23. The breakeven (the amount of widening in the index required to wipe out the excess carry) is 36% of the iBoxx index spread.

Figure 2. iTraxx Main dispersion\*



Source: Citi Research. MarkIt. \*St. dev. of single-name spreads divided by average spread. OTR index.

<sup>1</sup> If that's what you are looking for, then please click [here](#).

<sup>2</sup> In this calculation we have assumed the same percentage tightening (15%) across rating buckets as for the index as a whole.

Figure 3. Portfolio characteristics against benchmark

	Portfolio	iBoxx € Corporate	Difference
AA-AAAs	0%	13.3%	-13.3%
As	17.9%	47.9%	-30.0%
BBBs	68.8%	38.8%	30.0%
iBoxx HY	13.3%	0.0%	13%
Current weighted avg. spread:	140.8bp	95.7bp	45.1bp
Beta:	1.23		
Breakeven:	36% widening in credit spreads		
Source: Citi Research			

### What do we want to hedge against?

It's an obvious question, but it's also non-trivial. The reality is that this will be very subjective from mandate to mandate.

But in our worked example, let's assume that we, as portfolio managers, are prepared over a 3-month period to weather the spread widening that would wipe out 18 months of the current excess carry on our portfolio (so  $1.5 \times 45\text{bp} = 68\text{bp}$ ) – but to the extent possible we want to hedge against widening beyond that. For the portfolio above, that translates into a widening in iBoxx of 36% (or 34bp) from current levels<sup>3</sup>.

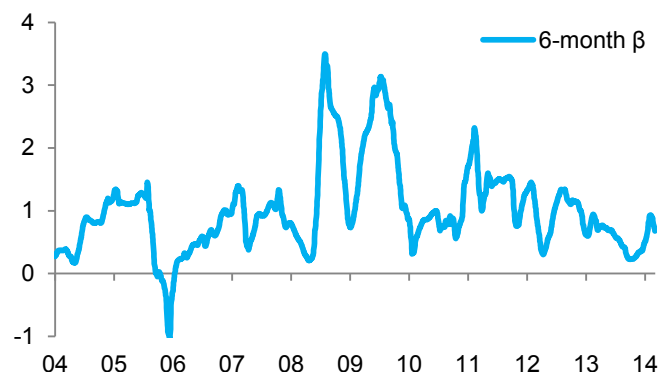
To our minds, that would be consistent with the kind of correction that the credit market might under normal circumstances experience about every 1-2 years or so without a turn in the broader cycle.

### How much iTraxx index exposure is needed to hedge the portfolio?

Unfortunately, iTraxx Main is not a perfect hedge for the iBoxx index. Different constituents, weightings and the cash-derivative basis itself can drive wedges between the performances of the two indices.

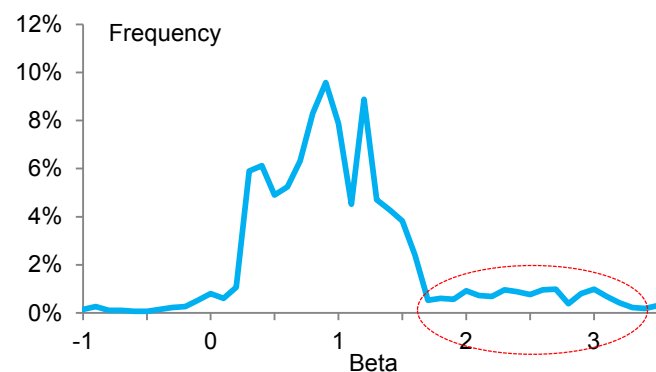
Over the last 10 years, the six-month beta in spread levels of iTraxx Main to iBoxx has averaged 1.0, but it has ranged between -1.0 and 3.5, as illustrated in Figure 4 and Figure 5.

Figure 4. Historical 6-month iTraxx to iBoxx  $\beta$ , 2004-14



Source: Citi Research, MarkIt

Figure 5. Historical 6-month iTraxx to iBoxx  $\beta$ , 2004-14, histogram



Source: Citi Research, MarkIt

<sup>3</sup> On the assumption that betas remain constant.

In particular, there is a fat tail in the distribution (circled in red), which reflects the period during 2008-09 where the basis spiked negatively by about 4.5 standard deviations as funded assets like corporate bonds sharply underperformed unfunded exposures, like CDS, in the scramble for liquidity.

So the "right amount" of iTraxx needed to hedge an iBoxx cash portfolio does vary significantly over time. However, while liquidity shortages may well be a feature of future crises, we'll go out on a limb and argue that with all the evolution in central bank support mechanisms they're unlikely to be on the same scale as 2008. Therefore we have excluded the extreme misalignment between cash and CDS during this period and focused on the subsequent experience<sup>4</sup>.

Another complication is that it's not the iBoxx index itself we're trying to hedge. We want to control the downside resulting from the *net exposure of our portfolio to iBoxx* with iTraxx Main, i.e. the downside in our active position. This only serves to increase the mismatch.

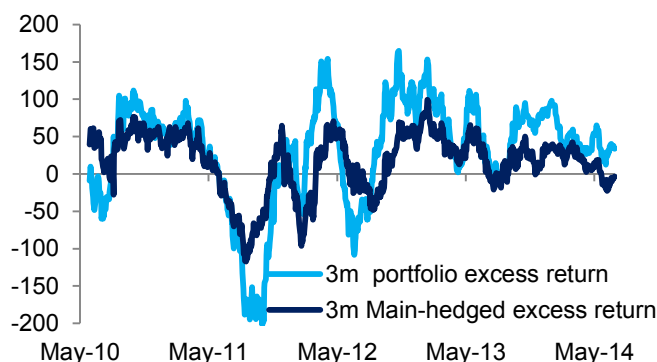
The hedge ratio we have chosen is therefore based on the following optimization run from June 2011 – June 2014:

$$\text{Max} \frac{\text{Cum. hedged excess return}}{(\text{95th percentile loss})^2}$$

It may look complicated, but it isn't— it's really just a modified Sharpe ratio. The numerator merely reflects that we want to maximize the return on the hedged portfolio over time<sup>5</sup>. The denominator in the ratio penalizes solutions that have elevated 3-month losses at the 95<sup>th</sup> percentile level. We do this instead of the conventional  $\beta$  in a regression to avoid fitting periods where the portfolio is performing, focusing only the period with extreme losses.

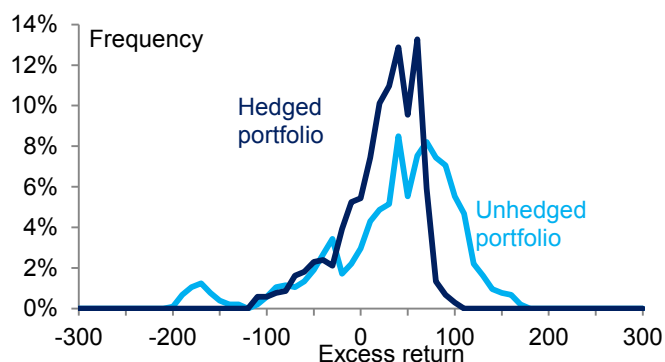
The optimal hedge ratio that results is 0.34. In other words, we'll need €340mn of iTraxx Main protection to hedge an underlying portfolio of €1bn.

Figure 6. 3m portfolio excess return , unhedged & hedged, bp, 2010-14



Source: Citi Research, MarkIt

Figure 7. 3m portfolio excess return , unhedged & hedged, histogram



Source: Citi Research, MarkIt

Does it do the trick? Well, in Figure 6 and Figure 7, we have calculated the historical monthly excess returns of the hedged and the unhedged portfolio.

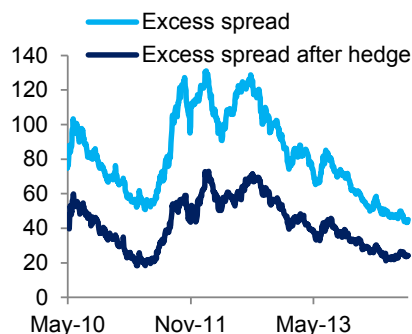
The hedge almost cuts the volatility of our 3-month excess return in half. It also reduces the biggest loss from 200bp to about 118bp in return terms. That's clearly

<sup>4</sup> Ahem, this also happens to be rather convenient given that we don't have reliable options data that far back.

<sup>5</sup> The "hedged excess return" is: *our portfolio excess return - the return on iTraxx \* hedge ratio*.

much higher than the maximum loss we had targeted, illustrating how difficult it is to construct hedges that work consistently. But 95% of the time the 3-month hedged excess return would have been better than -72bp – close enough to the loss tolerance threshold we set and considerably better than the equivalent -155bp on the unhedged portfolio.

**Figure 8. 3m excess spread, unhedged & hedged, 2010-2014, bp**



Source: Citi Research, MarkIt.

But the charts should also demonstrate why constantly hedging with iTraxx Main protection is a non-starter: most of the upside is evidently lost in the hedged portfolio. Currently, with iTraxx Main at 61bp, buying protection in that ratio would leave the excess carry on the portfolio at just 24bp (Figure 8).

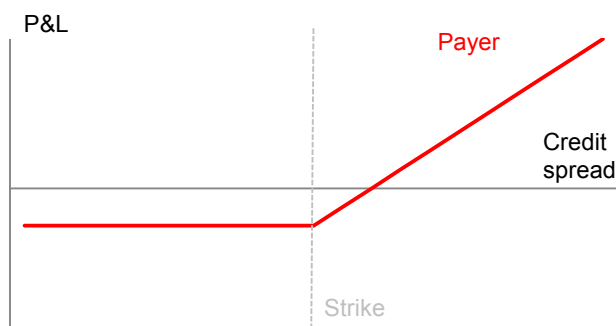
But that's where an option strategy might help!

### Why payers?

A European payer option in credit is the right to pay a certain spread for protection ("the strike") on a pre-specified maturity date, no matter what the actual market level on that date. In other words, if spreads are wider than the strike then the holder of the payer can buy protection cheaply (which can then be unwound at a profit). If spreads are tighter than the strike, then option expires worthless. For this right, you pay an initial premium. The theoretical pay-off for a payer at expiry is illustrated in Figure 9.

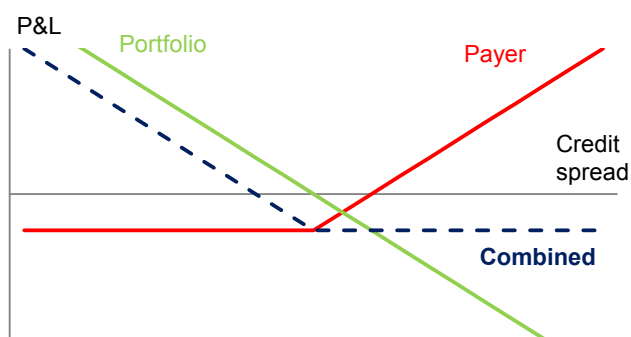
Now combine that with a conventional bond portfolio, where the (instantaneous) P&L for modest changes is almost linear with the spread level (Figure 10). In a perfect world, where the payer is a perfect hedge for the portfolio, it can effectively cap the downside, whilst only diminishing the upside by the amount paid in premium (see 'Combined' in Figure 10).

**Figure 9. Stylised payoff for buying a payer by spread at expiry**



Source: Citi Research

**Figure 10. Stylised payoff of a portfolio hedged with a payer by spread**



Source: Citi Research

Reality, though, is evidently a little more complicated than that. As the option references iTraxx it won't be a perfect hedge for iBoxx, let alone the net exposure in our portfolio. The value of the option also varies with other factors than the index level itself, such as volatility and time to maturity. And, the market typically charges a premium (the "skew") on the value of an option where the strike is far above the current market level compared to an option that is at the money.

Though our new [option pricing tool](#) makes it very easy for investors to calculate returns on their own option strategies, the implication is that that picking the "right" – or rather, most efficient – option to hedge with is again non-trivial.

## How would that work out using payers in practice then?

We've gone through various combinations of option deltas, maturities and whether to roll the options or not<sup>6</sup> to find the combination which again maximizes the cumulative hedged excess return, but penalizing for large losses as before.

Figure 11 illustrates that many of the options strategies can't reduce the downside appreciably from the unhedged portfolio. But longer-dated options have generally fared better. 6-month 10% delta payers rolled monthly (equivalent to 130bp strike Dec-14 options currently), in particular, have capped the downside as effectively as iTraxx at a 95<sup>th</sup> percentile level, so we have chosen to work with these. The hedge ratio calculated of 1.39x implies that for a billion of portfolio exposure, we'd need to buy 1.39bn notional of payers.

So how well does the strategy work? As illustrated in Figure 12, the option-hedged portfolio generally does very similarly to the iTraxx-hedged portfolio during sell-offs apart from a brief period in September 2011, where the 3-month loss is somewhat larger, peaking at 156bp. Equally though, there are extended periods where the option-hedged portfolio does slightly better than the iTraxx-hedged portfolio.

It may not look particularly earth-shattering, but over time it makes a big difference. Figure 13 shows the cumulative performance of the three portfolios (unhedged, iTraxx-hedged and option-hedged) together.

During the difficult period in 2011-12 the option-hedged portfolio performed much like the iTraxx-hedged portfolio, significantly outperforming the unhedged portfolio. And in the subsequent rally, the option-hedged has retained much more of the upside than the iTraxx-hedged portfolio.

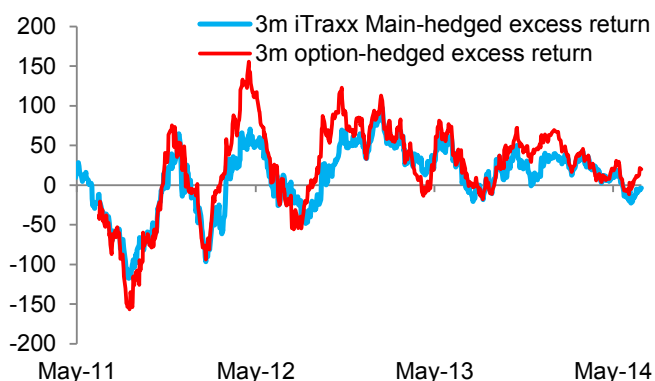
Since June 2011, **the cumulative excess return of the option-hedged portfolio is 263bp. The iTraxx-hedged portfolio only returned 115bp<sup>7</sup> – that's a difference of 1.5%.** That in itself makes the case for looking at options strategies as clearly as anything.

Figure 11. Option hedged portfolio loss at 95<sup>th</sup> percentile level by option type, bp

Maturity	----- Delta -----		
	10%	25%	50%
<b>Held to maturity</b>			
1m	-155	-155	-155
3m	-106	-84	-99
6m	-100	-102	-89
<b>Rolled monthly</b>			
1m	-155	-155	-155
3m	-90	-155	-125
6m	-73	-82	-95

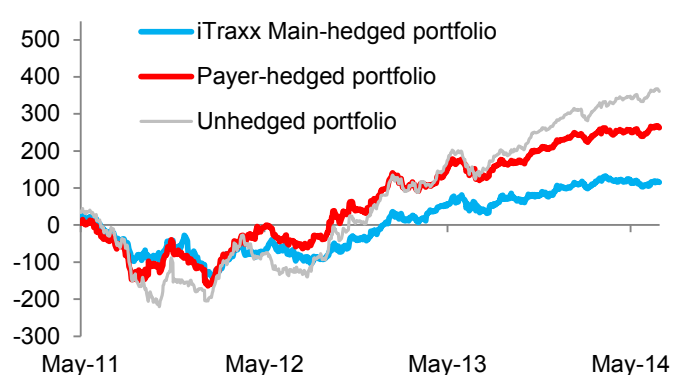
Source: Citi Research. Note: Estimated period from June-11 to June-14

Figure 12. 3m excess return, portfolio hedged with option vs. portfolio hedged with iTraxx, bp



Source: Citi Research, MarkIt.

Figure 13. Cumulative performance, unhedged, iTraxx-hedged and option-hedged portfolios, bp

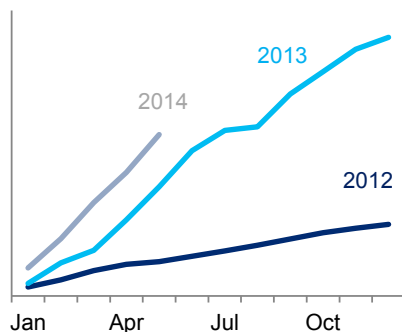


Source: Citi Research, MarkIt.

<sup>6</sup> We have worked with an assumed bid-offer cost of 1 cent, which we think is feasible looking across the market in the current environment. However, the qualitative conclusions would not have changed materially had we used a higher bid-offer of, say 2-3 cents.

<sup>7</sup> The unhedged portfolio has not surprisingly fared better still with a cumulative return of 360bp.

**Figure 14. Cum. notional options volume traded in € since beginning-of-year, Main equivalent**



Source: Citi

### Is it workable?

One factor to consider is evidently that the hedge ratio we found above implies that many of the larger funds would need to buy relatively large amounts of options for the hedge to have a meaningful impact on their aggregate portfolio performance. That naturally raises the question as to whether it is feasible, especially in a new market like credit options, where liquidity was very poor only a few years ago.

In the current market, we'd argue that it is indeed possible to hedge even relatively large exposures. We don't, as yet, have published data on option volumes going through the whole market. However, based on Citi trading data we estimate that volumes YTD are more than three times the equivalent in 2012 (Figure 14).

Moreover, we guesstimate that somewhere in the region of 20% of daily index trading volumes are derived in one form or another from options. On days with sharp spikes in volatility it may be as much as 50% - more than enough to have a significant bearing on the direction of the index itself.

Real money accounts used to be a very small share of the flow (~10%), but we believe they now make up about a quarter of total volumes.

More pertinently, it is fairly common to see 1bn+ tickets going through the market. The bid-offer on individual trader runs, even in a long-dated, far out-the-money strike like the one used in our example above is currently 2-3 cents, which ought to work out tighter than that for a client with access to multiple dealer quotes.

Would the liquidity survive in a stressed market environment? It probably wouldn't. But that is another good reason for looking at longer-dated options, where the instantaneous rollover risk is much lower.

### Would you be better off using options in another asset class?

Credit options aren't known for being 'cheap', in the sense that the level of volatility implied by pricing has often been significantly higher than the realized volatility in the market. At the moment [implied volatility on iTraxx is about 1.3x realised](#), compared to options on EuroStoxx, 10-year swaps and the EURUSD, where the ratio is between 1.0-1.1x.

However, these ratios do vary over time – only in March the ratio in iTraxx was close to 1.0x, and the absolute level of volatility is extremely low. More importantly, the reliability of the hedge is important. Even if you could establish a suitable historical correlation between, say, rates volatility and the excess return on your portfolio, such a relationship seems much more prone to regime changes and or structural breaks than a hedge with a credit product – especially under stressed scenarios, where default risk and other factors suddenly become the principal drivers of credit risk premia.

Another alternative would be to use iTraxx tranches, but that too comes with significant challenges. First and foremost, there isn't currently the necessary liquidity in the market. Secondly, either you have to buy protection on junior / mezzanine tranches, which is expensive, or you face the problem that the value of senior tranche protection is comparatively insensitive to index spread levels, unless you get a repeat of a 2009-type scenario.



## Conclusion

Caveat emptor – we recognize that in real life hedging a portfolio with options would ideally require more comprehensive analysis and simulations than we have done here. The comparative lack of historical data in the options market makes it difficult to establish reliable relationships. Optimal hedge ratios will vary over time.

Our main objective has been to illustrate the potential power of hedging with options. They aren't a free lunch. They aren't a perfect hedge – neither against the cash index, nor against the net exposure to that benchmark, especially should the market find itself strapped for liquidity again one day.

But consider the alternatives. Hedging with iTraxx isn't perfect either and has proven far more expensive over time, wiping out much of the excess carry. Hedging with equities, equity derivatives or another asset classes might be "cheaper", but would you feel comfortable in weakening the link to the credit exposure in your portfolio even further?

The options market in Europe is still nascent, but it has been expanding rapidly. And we reckon that in the current environment it offers an attractive way of reducing the tail risk embedded in most real money portfolios – without eliminating the excess carry.

As concerns about the ultimate sustainability of valuations mount and the illiquidity on a risk-off day is on everyone's mind, we really reckon it's a good time for real money accounts to consider all their options.

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