02 June 2020

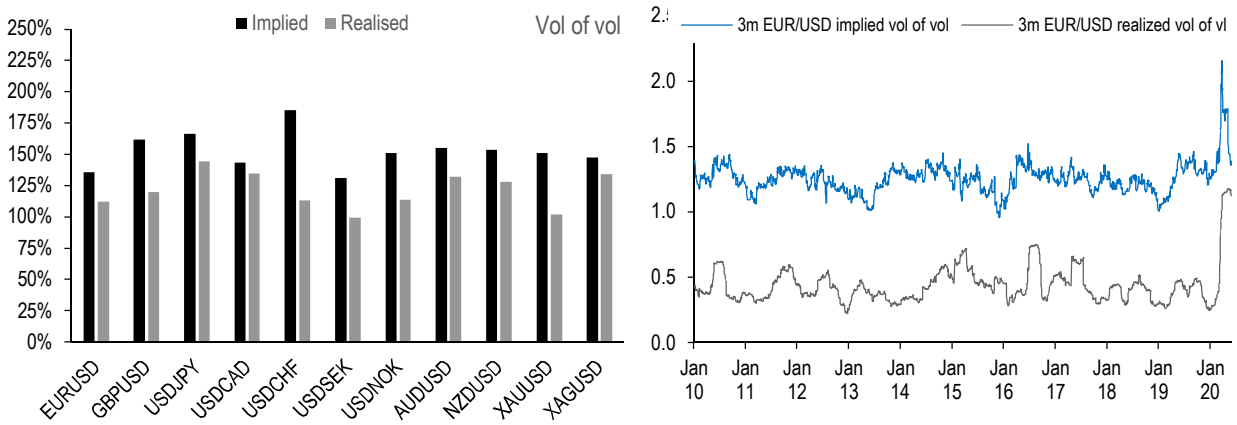
JPM FX - Derivatives Chartpack Notes

Softer than shadow and quicker than flies - A first glance at FX vol of vol strategies

- We reprise some work from academic literature investigating the potential of systematically selling FX wings while at the same time reducing directional exposure to Vega and Gamma traditional axes of risk, getting an exposure to the so-called Vol-Gamma (or Volga) risk sensitivity / options Greek letter.
- Long-term backtests confirm the elevated potential of these strategies, but also the high sensitivity to trading costs, possibly limiting the potential of the implementation of these "pure" short vol-of-vol strategy to dedicated trading desks. However, we show a number of practical takeaways allowing a wide audience of clients to benefit from the aforementioned premium via hybrid Gamma and Volga strategies.
- Following the sharp drop of FX butterflies from the March highs, we see current opportunities in the plain vanilla convexity space on USD/CHF and USD/NOK. For both cases, we propose a 1M long straddle / short 25delta strangles implementation.

Introducing the notion of FX vol of vol risk premium. The decline of FX vol levels, especially in the G10 space, post March highs supports the notion of looking at RV and de-correlation structures, especially in the G10 space, a theme we have supported over the past few weeks – see recent note. Given the usually positive correlation between pro-USD directionality and pricing of vols, the latest emergence of a marked risk-on driven drop of the USD should favor looking directly at Theta-positive constructs. Keeping in mind the once-again depressed levels of vols, that do not longer price in much premium despite the dire conditions global growth, is going to face, looking for some extra juice to reap from smiles could be appealing. Previous pieces on ratio spreads (see for instance *All weather vol ratio spreads excel when primed with risk on/off filter*, Jankovic, 1 April and, *Oddities in the AUD vol complex*, Sandilya, 30 April) displayed the potential as these structures for milking a positive theta from FX smiles over the long run – however these spreads are exposed on both skew and vol convexity parameters, and could in principle benefit from risk premia on both.

Exhibit 1. Current implied vs. realized 3m vol of vol on USD/G10 pairs. Time series for EUR/USD
Implied vol of vol comes from a SABR calibration whereas realized one is the 3m rolling realized vol of fixed maturity 3M ATM vol.



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By focusing specifically on the smile convexity topic, a first look at current conditions in the G10 space shows indeed a small premium as far as the pricing of vol of vol is concerned (Exhibit 1, LHS), with a similar picture in play for EM vols. However, we stress how this premium is currently at its historical tightest (Exhibit 2, RHS, case study on EUR/USD), on the back of the stressed pricing environment across the COVID-19 health crisis, especially this March, which led to a repricing higher of both implied and realized vol of vols. Being **related to**

the pricing of wings, one obvious interpretation for the rise of such parameters is purely sentiment-based, driven by different market participants buying more aggressively OTM options in a risk-off market, with hedgers looking for low-premium structures and global-macro players for high-leverage, for instance. A second flow-based interpretation, although probably secondary in terms of size, could attribute such repricing to exotics structures, like DNTs, that sell ATM vol while buying wings. While introducing the possible interplay of the two effects, we stay away from a more quantitative comparison of their relative importance.

In any case, the chart above (Exhibit 1 – RHS) shows that in the long run, implied vol-of-vol prices in a significant premium over realized vol-of-vol. Previous research published on academic literature (*Isolating a risk premium on the volatility of volatility*, Ravagli, Risk magazine, December 2015) shows that such premium should be related to a tradable quantity, via the so-called Vol-Gamma (also known as Volga or Vomma) risk sensitivity:

$$PnL \approx Volga * ({v^2}_{real} - {v^2}_{imp})$$

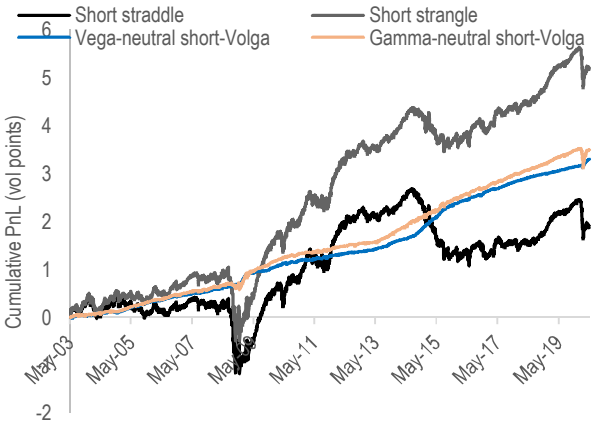
where v_{imp}, v_{real} are implied and realized vol of vols and $Volga \equiv \partial Vega/\partial Vol$. Given that ${v^2}_{real} - {v^2}_{imp}$ is usually negative, short-Volga trades are structurally supported. **In the plain vanillas space, trading vol of vols can be achieved by buying ATM vols and selling wings with some suitably adjusted notionals, and after delta-hedging.** In the rest of this introductory note, we will restrict our attention to pure vol of vol strategies, i.e. trades that are especially sensitive to the convexity of the smile, but less so to the skew. As the topic is quite technical and involves a heavy formalism to deal with, we will limit ourselves sharing some high level results here before discussing more extensively the matter in a longer and more detailed note later this summer.

Short vol of vol backtests via FX plain vanillas – case study on EUR/USD. We will present backtests that can help shed some light on the potential of short FX vol of vol trades. In this piece, we will limit ourselves to considering plain vanilla structures, typically involving combinations of straddles and strangles, which, given the symmetric exposure on strikes, should insulate the trades from residual skew exposure. Given the different sensitivity to wings pricing, var vs. vol swap trades are a natural channel for playing the theme via exotics, and so are options on options, although liquidity might prove more challenging in the latter case. Exotics implementations of the theme will be covered in more details in future research.

Exhibit 2. EUR/USD 1d holding – summary of results and time series of 1m short straddle, strangle and short-Volga strategies at zero transaction costs.

In the right-hand side chart, the two different implementations of the short-Volga portfolios correspond to Gamma- and Vega-neutrality constraints.

	Sharpe ratios for 1d holding - zero cost		
	Straddle	Strangle	Vega-neutral short-Volga
1w	0.62	1.17	5.76
1m	0.23	0.64	4.35
3m	0.32	0.63	2.61



Source: J.P. Morgan

Without entering into technicalities here, the functional expression of Greek letters shows that Volga exposure builds up by moving away from ATM strikes and adding exposure to wings. In other words, a short-dated straddle should be mostly exposed to Gamma while for a strangle there will be sensitivity on both Gamma and Volga. Playing around with relative scaling of notionals between straddles and strangles should allow isolating the desired composition of the portfolio. Given the highest liquidity across all currency pairs, we start by taking EUR/USD as the case study for several investigations involving straddles, strangles and long / short combinations. We will focus on liquid 25delta strangles for avoiding deep OTM options, where liquidity is

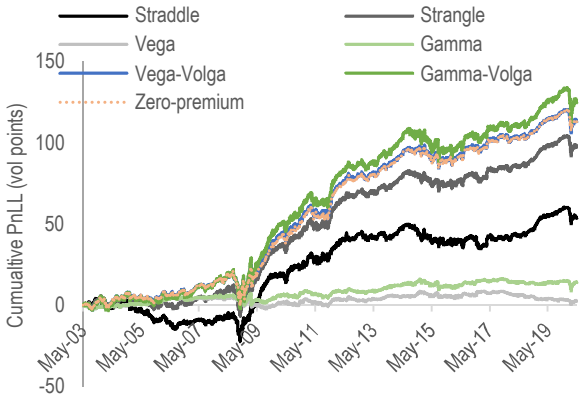
harder to come by and pricing more model-dependent. For maturities, we consider 1w, 1m and 3m, although the 1w will be mostly only looked as part of this case study given its lower liquidity / wider trading costs in practice.

We start by testing the limit case study of 1d holding periods. While this represents a fully theoretical case study, as the impact of costs would be absolutely punitive, it allows testing the presence of the vol of vol premium, at least for zero transaction costs, and checking other interesting observations. This high-frequency rebalancing limit case would be expected to be the closest to the pure "vol of vol" implementation: in fact, after imposing the Gamma-neutrality / short-Volga constraint at inception, one would generally expect spurious sensitivities to kick-in during life of an option, and the effect would be larger for longer maturity products. For the current purpose, we'll start by displaying Sharpe ratio results corresponding to short-straddle and strangle and Vega-neutral short-Volga strategies, for all three maturities and for zero trading costs (Exhibit 2, LHS).

The high numbers for the zero cost Sharpes for the short-Volga portfolios vs the short-Gamma ones are a remarkable feature, but one can also see how in this limit strangle outperforms straddle on the Sharpe ratio metric. In the second chart (Exhibit 2, RHS), we display the time series for the 1m Expiry, 1d holding period zero transaction cost EUR/case corresponding to short straddle, strangle and Vega-, Gamma-neutral short-Volga portfolios – PnLs are expressed in cumulative vol points (expressed in terms of the straddle Vega notional). The steady PnL buildup of the short-Volga portfolios, associated with very little volatility, is typical of strategies capturing a genuine premium. Needless to say, while these results could be appealing for market making desks, they will have to pass through the scrutiny of transaction costs before calling these premia as tradable. **Still, in this ideal limit of zero costs / 1d holding periods, the correlation between 1m short straddle and Vega-neutral short-Volga strategy vs. the Gamma-neutral short-Volga portfolio would be -34% and +50%** (the latter signs can be understood as in the former case the portfolio would be slightly long Gamma). **These results confirm not only the presence of this wings premium, but its low-correlation with the well-known volatility premium.** Low correlation of risk premia strategies is a powerful ingredient for boosting the diversification properties of multi-strategy portfolios. It is also possible to show that the daily PnL generated by the short-Volga strategy, as displayed in the chart, matches nicely the one as obtained from the formula above, but this goes beyond the illustrative purpose of this introductory note.

Exhibit 3. EUR/USD held to Expiry – summary of results and time series of 1m short straddle, strangle and short-Volga strategies with transaction costs accounted for.

		Sharpe ratios			
Tenor	Scaling	Straddle	Strangle	Short-Volga	Vega notionals ratio
1w	Vega	0.38	1.07	0.74	1.00
1w	Gamma	0.38	1.07	1.06	1.13
1w	Gamma_Volga	0.38	1.07	1.19	2.27
1w	Vega_Volga	0.38	1.07	1.29	2.00
1w	Zero Premium	0.38	1.07	1.29	2.01
1m	Vega	0.39	0.71	0.06	1.00
1m	Gamma	0.39	0.71	0.26	1.12
1m	Gamma_Volga	0.39	0.71	0.66	2.25
1m	Vega_Volga	0.39	0.71	0.74	2.00
1m	Zero Premium	0.39	0.71	0.74	2.00
3m	Vega	0.44	0.60	-0.09	1.00
3m	Gamma	0.44	0.60	0.15	1.12
3m	Gamma_Volga	0.44	0.60	0.56	2.23
3m	Vega_Volga	0.44	0.60	0.60	2.00
3m	Zero Premium	0.44	0.60	0.60	1.97



Source: J.P. Morgan

We now move to the realistic case study where trading costs are accounted for. 1d holding periods would prove unfeasible after accounting for costs (and also difficult to manage in practice even assuming the possibility of trading at mid) – longer holding periods are needed for overcoming the impact of costs, assumed to be paid at inception. On the other hand, as discussed earlier, the passing of time will introduce spurious sensitivities to the portfolio's Greek letters – high frequency rebalancing / restriking would be needed for ensuring unwanted sensitivities are reduced. In the following, we will consider the conservative scenario where all trades are kept in the book until Expiry – in practice, a compromise scenario where portfolios were rebalanced every week or two could prove realistic, but that exercise will not be carried out here. For EUR/USD, we assume a 0.3 vol points bid/offer vol spread, constant over time and across deltas. When trading long/short structures, we'll assume to pay the spread just on the straddle leg. While further work might be required for being fully aligned with standard market practices, we are confident that this setup represents a good starting point. As we enforce daily delta hedging on each construct, we assume to pay 0.01% b/o on each delta trade.

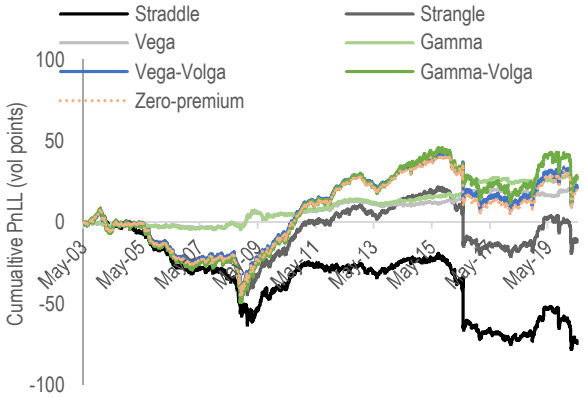
In Exhibit 3 LHS, we summarize the Sharpe ratios for the different structures, including costs this time. For the short-Volga portfolios, we consider different relative Vega notionals for the two legs: zero premium, Vega and Gamma-neutral. We also consider Vega-Volga and Gamma-Volga scalings, whereby the weight associated with the short-strangle leg is doubled compared to the Vega- and Gamma-neutral cases, respectively. Note that this latter choice is arbitrary and an optimal ratio might be the result of an optimization procedure. Relative scalings allow sizing up the risk exposure of the resulting portfolio – for instance, by imposing a Vega-neutrality constraint, the portfolio will be slightly long-Gamma at inception. Gamma- and Vega-neutrality will be the closest to the pure vol of vol implementation, but also the ones that will suffer the most the impact of trading costs. The more aggressive short-wings position associated with the other scalings will bank on both vol and vol of vol premia thanks to hybrid Gamma and Volga risk sensitivities.

When comparing results, the first practical takeaway we learn is that strangles offer a better vehicle that straddles for implementing the short-volatility risk premium strategy, with the additional cushion provided by the vol of vol premium and by the lesser impact of delta-hedging costs (the delta profile being less volatile). These results are visually summarized, for the 1m case, in the Exhibit 3, RHS. We also see that, as expected, "pure" vol of vol strategies are left with little potential after costs are included (Vega and Gamma cases in Exhibit 3 are the two cases associated with lowest Cumulative PnLs). Especially for the short-dated maturities, hybrid strategies mixing Gamma and Volga sensitivity are those associated with the highest Sharpe ratios.

As a concluding remark, we have seen that a two legged long straddle vs. short strangle construct, with both options of the same maturity, has a degree of freedom for imposing either a Gamma- or Vega-neutrality constraint, but not both, on top of the short-Volga one. By considering a three legged construct including another longer maturity straddle, one could impose at the same time Gamma- and Vega-neutrality constraints to the short-Volga trade. These are the constructs that would be associated with the highest Sharpe ratios, although a more detailed analysis will be deferred to future studies.

Exhibit 4. Full table of USD/G10 results – 1m options and Vega scaling. Case study on 1m GBP/USD PnL time series.

		Sharpe ratios		
Currency	Scaling	Straddle	Strangle	Short-Volga
EUR-USD	Vega	0.39	0.71	0.06
GBP-USD	Vega	-0.38	-0.07	0.48
USD-JPY	Vega	0.20	0.37	-0.15
USD-CHF	Vega	-0.33	-0.14	0.17
USD-CAD	Vega	-0.41	0.00	0.33
USD-NOK	Vega	-0.33	-0.21	-0.72
USD-SEK	Vega	-0.20	0.02	-0.05
AUD-USD	Vega	-0.31	-0.22	-0.37
NZD-USD	Vega	-0.37	-0.28	-0.35



Source: J.P .Morgan

Short vol convexity trades across G10 and EM pairs. We then apply a similar approach to other USD/G10 crosses, by limiting the analysis to 1m options, and for simplicity by applying same cost structure as for EUR/USD, approximation whose validity would depend on market conditions. Data are from May 2003. Generally speaking, as stressed in previous research (see for instance *Timing FX short-vol strategies*, Ravagli, Duran-Vara, March 2019), the outright appeal of the short-Gamma theme in G10 is rather limited, which is confirmed by the empirical analysis for 1m options (Exhibit 4, LHS): the added value of using strangles over straddles is however confirmed. The de-correlation of the short-Volga strategy, implemented via Vega-neutral notionals on the back of tight vol premia, with short Gamma strategy is generally confirmed, although results are not spectacular in absolute terms, given the heavy burden of vol costs. In several cases, GBP/USD, USD/CHF, USD/CAD, the RV structure outperforms the short-Gamma strategy in terms of higher Sharpe ratios and more contained drawdowns. For cable (Exhibit 4, RHS), the outperformance was especially marked across the 2016 Brexit referendum episode.

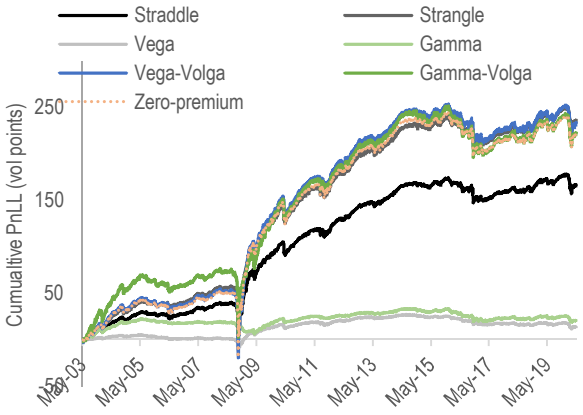
For EM currencies, we assume wider trading costs, with 0.5 vol points bid/offer vol spread and 3bps b/o on each delta trade. Backtests start in May 2003, with the exception of USD/TRY (2006) and USD/CNH (2011). The summary of results for a set of liquid USD/EM crosses (Exhibit 5, LHS) confirms the better appeal of selling vol

via strangles over straddles. For the short-Volga strategy, we display in this case the 1:2 straddle vs. strangle Vega notionals. Compared to the earlier examples, the higher impact of transaction costs does not allow outperforming the short-Gamma benchmark in terms of higher Sharpe ratios.

Exhibit 5. Full table of USD/EM results – 1m options. Case study on 1m USD/MXN PnL time series.

		Sharpe ratios		
Currency	Scaling	Straddle	Strangle	Short-Volga
USD-BRL	Vega_Volga	0.84	0.91	0.70
USD-MXN	Vega_Volga	0.84	0.92	0.74
USD-TRY	Vega_Volga	1.04	1.12	0.93
USD-ZAR	Vega_Volga	-0.49	-0.48	-0.50
USD-PLN	Vega_Volga	-0.13	-0.10	-0.20
USD-HUF	Vega_Volga	0.04	0.13	-0.15
USD-KRW	Vega_Volga	0.95	1.04	0.82
USD-SGD	Vega_Volga	0.62	0.82	0.24
USD-CNH	Vega_Volga	0.73	0.88	0.52
USD-INR	Vega_Volga	1.80	1.95	1.58
USD-TWD	Vega_Volga	-0.18	0.02	-0.53
USD-IDR	Vega_Volga	1.95	2.07	1.88

Source: J.P. Morgan



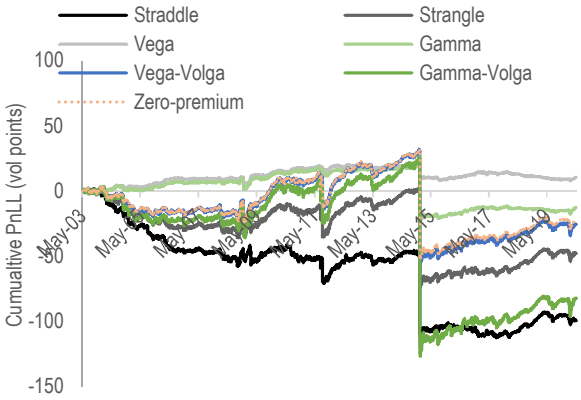
A case study on USD/MXN (Exhibit 5, RHS) shows that in this case "hybrid strategies" are roughly aligned with the short-strangle strategy as far as returns are concerned, outperforming straddles but proving also slightly more volatile.

Current opportunities in the FX vol convexity space. As discussed earlier, after spiking in March, the pricing of wings receded sharply thereafter. At present, a RV analysis on the pricing of flies/vols across USD/G10 pairs points to elevated flies pricing on CHF and NOK (Exhibit 6, LHS), which is consistent with the premia analysis of Exhibit 1.

Exhibit 6. RV on 1y flies/vols finds CHF and NOK wings as overvalued. Time series of USD/CHF strategies.

z-scores	EUR-USD	GBP-USD	USD-JPY	USD-CHF	USD-CAD	USD-NOK	USD-SEK	AUD-USD	NZD-USD
EUR-USD	0.71	-1.30	0.46	-4.00	-1.24	-1.44	-0.36	-0.57	-0.68
GBP-USD	1.30	1.50	1.66	-1.97	-0.02	-0.62	1.00	0.73	0.58
USD-JPY	-0.46	-1.66	0.62	-2.94	-1.21	-2.31	-1.03	-1.06	-1.16
USD-CHF	4.00	1.97	2.94	2.08	2.40	0.85	2.18	2.33	2.25
USD-CAD	1.24	0.02	1.21	-2.40	1.04	-0.34	0.56	0.45	0.35
USD-NOK	1.44	0.62	2.31	-0.85	0.34	3.56	3.49	1.53	1.26
USD-SEK	0.36	-1.00	1.03	-2.18	-0.56	-3.49	1.78	-0.42	-0.55
AUD-USD	0.57	-0.73	1.06	-2.33	-0.45	-1.53	0.42	1.27	-0.63
NZD-USD	0.68	-0.58	1.16	-2.25	-0.35	-1.26	0.55	0.63	1.28

Source: J.P. Morgan



The macro team has recently turned more bullish on the Norges Krona, on the back of more supportive market sentiment, still dislocated NOK pricing and Norges Bank's possible involvement into FX sales / NOK purchases (see *FX markets weekly – If you can't beat 'em…stand aside*, Meggyesi, 29 May). Richness of NOK vol convexity to be expressed via straddle vs. strangle or call fly (long ATM / short 25delta / long 10delta, with notionals chosen for resulting into a net zero Vega) constructs was discussed in a recent note. On CHF, the strategy team keeps a bullish bias on the currency, identified as one of the least susceptible to COVID-19 ramifications for fiscal and monetary expansion, and supported by the collapse in interest rates differentials between the currency and other major currencies' disincentivise private outflows. From the time series analysis (Exhibit 6, RHS), we can see that the Vega-neutral straddle/strangle implementation weathered the January 2015 depegging event well; given lackluster long-term performance, however, the highlighted opportunity would mostly be related to current elevated pricing of wings more than the long-term strategic potential.

In both cases, the ongoing short-USD / long risk trend is supporting a tactical tightening of vol levels, which on its turn might favor choosing more aggressive vols/wings selling constructs in terms of relative notional sizing. The higher vol of vol and tighter vol premium supports the Vega-neutral implementation on USD/CHF; for USD/NOK, higher level with wider premium on the vol favors the more aggressive 1:2 ATM vs. wings scaling.

Consider:

- Long 3m straddle @6.2 ch. / short 3m 25delta strangle @ 6.25/6.55 indic. in 1:1 Vega notionals on USD/CHF, keep delta-hedged

- Long 3m straddle @11.9 ch. / short 3m 25delta strangle @12.05/12.45 indic. in 1:2 Vega notionals on USD/NOK, keep delta-hedged

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