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Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

FX Strategy
21 November 2017

J.P.Morgan

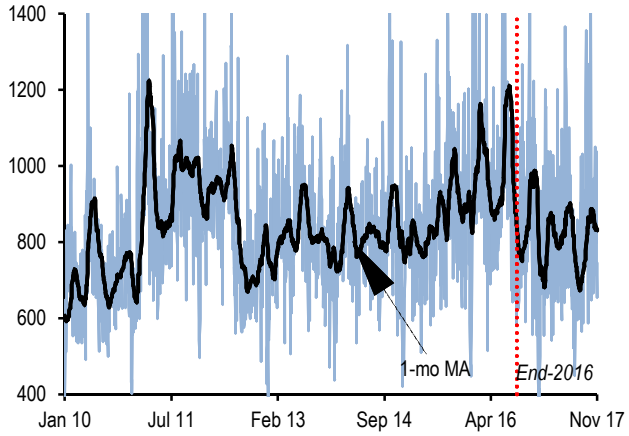
FX Volatility: Goldilocks is in the price

- **Upbeat sentiment and heavy length in high-beta/EM FX at the tail-end of 2017 could not be more starkly different to the terror of policy disruption at this time last year. Consensus macro bullishness for 2018 is more than discounted by cheap FX vols however. VXY Global (7.6) is 1-sigma cheap on a cyclical model and should mean-revert towards 9.0 in the back half of next year as Fed hikes and balance sheet tightening begin to bite. Normalization, not an eruption.**
- **Instead of classic gamma selling where value has been largely exhausted, vol alpha next year is best sourced via (i) option-based carry that exploit high carry/vol ratios – buy 6M ATMF/ATMS put spreads in EUR/CNH and EUR/RUB; (ii) call overwriting on EM longs to yield-enhance while taking advantage of depressed risk-reversals ; and (iii) owning cheap, bleed-friendly convexity in long-dated, low-delta calls in high-yielding currencies (BRL/JPY, EUR/RUB).**
- **We explore systematic selling 4-of wk double no-touches (DNTs). Short-dated DNTs are best sold in EM FX with prices around 20% with currency selection conditioned on a mix of trend strength (ADX) and noise (implied / realized vol ratios) factors.**
- **Discretionary defensive positions are best installed via USD/JPY 1Y1Y FVAs, EUR/GBP 6M6M FVAs, long-dated EUR/TRY straddles, -6M/+1Y gamma-neutral calendars in USD/CLP and short 1Y GBP vs. JPY correlation via USD.**

The growth vs. value dilemma for FX vol in 2018

2017 is a year best forgotten in a hurry for investors who found themselves on the wrong side of a bullish view on vol early on predicated on a regime shift in US fiscal policy and international trade politics. An adage about volatility is that it spikes when shocks are the least expected and rarely jumps when anxiety is widespread; in hindsight then, the crisis-like flare-up in non-price based measures of risk-aversion after the US elections around this time last year (chart 1) should have cautioned against embracing the bull market in fear that characterized the period leading up to and in the early days of the Trump Presidency. As it turned out, a passive short vol strategy on a VXY-weighted basket of straddles delivered an impressive 5 % pts. of P/L, the bulk of it concentrated in 1H as the Trumpflation trade de-priced and French elections passed uneventfully (chart 2).

Chart 1. Non-price based measures of risk aversion based on story counts of 'fear' or its synonyms had peaked to EU debt crisis highs after the US elections in 2016, but indicate complacency currently
Number of Bloomberg news stories with a mention of "volatility", "turmoil", "panic", "fear" or "anxiety"



Source: J.P.Morgan, Bloomberg

Chart 2. 2017 was a chastening year for vol bulls
Cumulative returns (vol pts.) from owning a VXY Global weighted basket of 3M ATM straddles. Options delta-hedged daily using smile forward deltas and option-expiry matched forwards/NDFs, and rolled into fresh options weekly. No transaction costs.

Source: J.P.Morgan

A year on from that historic election night, positioning and sentiment in risk markets could not be more different. Fear is notable by its absence: the consensus is bullish most asset markets as they make new highs; bull/bear sentiment readings for stocks is in peak risk-on territory; the price of FX volatility (VXY) has plummeted to the bottom decile of its 25-year history, as it has in all other asset classes; the story count measure in chart 1 has slippedinto complacent territory; USD longs at the beginning of the year have flipped to sizeable shorts notwithstanding the liquidation of the last 2-3 weeks; and EM investors are more than constructively positioned judging from our client surveys and feedback from the IMF/WB meetings in October.

Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

This confluence of optimism is typically 'late cycle' and grounded in the broad-based cyclical lift witnessed this year and expected to continue next year. JPM Economics expects global growth to remain above-trend through 2018, generating the strongest sustained performance of this expansion. Such synchronous economic strength is powerful force, and a*ll else equal*, should help draw a straight line from consensus macro bullishness to another anemic year for volatility in 2018.

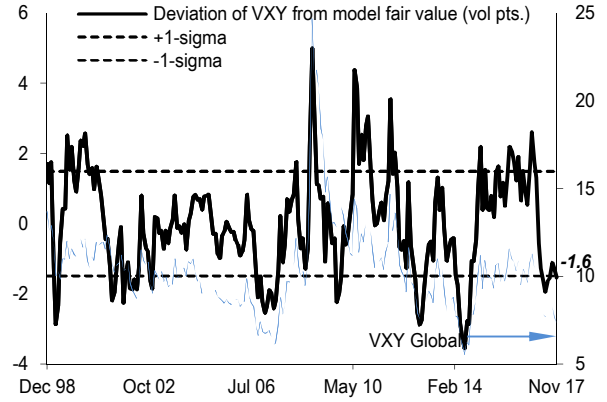
All else is not equal however. Absent another December eruption, VXY Global will be entering 2018 around 7.0, nearly 4%pts. below beginnning-of-2017 levels, a low only eclipsed by the three once-a-decade cyclical troughs of 1996 (6.2), 2007 (5.7) and 2014 (5.1) of the past 25 years.

Critically, a lot, if not all, of the good news on growth is already reflected in the vol price judging from our workhorse valuation model that incorporates the level of global activity (PMI), trailing variability of global PMI and consensus forecast dispersion as explanatory variables (chart 3). The extent of the current vol undervaluation – 1.6 % pts. at the time of going to print – exceeds -1 std. error, a threshold that in the past has been followed by slow burn mean-reversion over the next 9 months (chart 4).

In short, **value exhaustion is the principal risk to the vol bear trend of 2017**. How these offsets of deeply lopsided valuations and favorable cyclicals intersect will determine the fate of FX vol next year. The classical time worn pattern of clustering of low vol periods, and the timeline in chart 4 suggests that the window for scalping short vol may remain open till late Q1/early Q2, but the back half of 2018 should see a volatility revival as Fed rate hikes and balance sheet roll offs tighten financial conditions against the backdrop of an even larger build-up of carry-seeking positions than is currently the case. This is also consistent with late cycle dynamics that tend to initially pressure realized volatility lower, but a gradual uptick tends to take hold about a year before the onset of an eventual recession (chart 5). While there is no official expiry date on this expansion, the back half of 2019 has been commonly floated in as the potential start of the next recession; the timeline in chart 5 then supports the notion that 2H18 should begin to wake vol markets up from their year-long slumber.

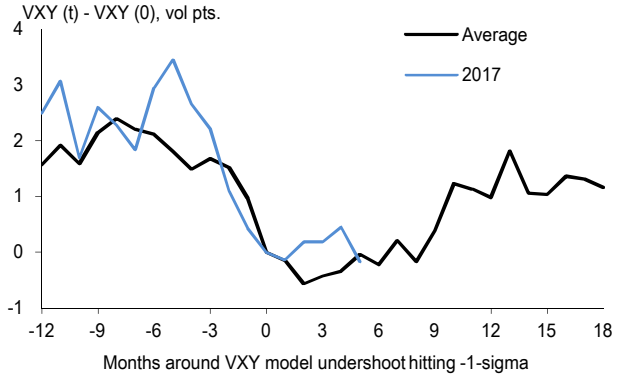
Based on these mean-reversion patterns, **we project VXY Global to end 2018 around 9.0**, about 1.5 pts. higher than current levels. That would still leave the index below its long-run average of 10%, hence the message is one of normalization within a constructive macro context rather than an eruption.

Chart 3. FX vol is cheap relative to coincident cyclical indicators entering 2018, and carry no risk premium for higher rates
Fair value model regresses VXY Global on JPM Global PMI, 12-mo rolling std. deviation of Global PMI and an equally weighted composite of the inter-quartile dispersion of the Philadelphia Fed's Survey of Professional Forecasters 4-qtr ahead forecasts for three macro variables: US real GDP growth, unemployment rate and headline CPI



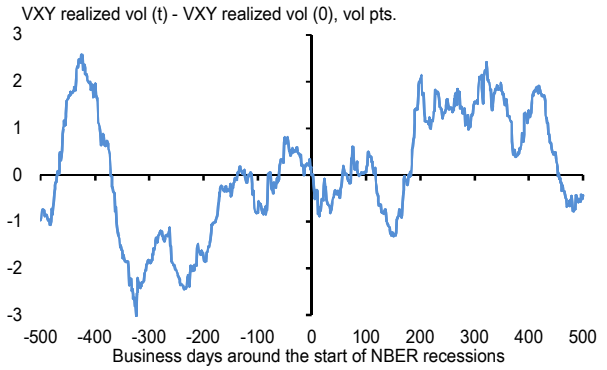
Source: J.P.Morgan

Chart 4. VXY is in the home stretch of its protracted U-shaped bottom of the mean-reversion cycle from multi-sigma lows of 1H17
VXY Global averaged around months when its undershoot vis-à-vis the cyclical fair value model above fell below -1-sigma. Zero dates used in the chart are Apr'99, May'01, Oct'06, Aug'12 and Feb'14.



Source: J.P.Morgan

Chart 5. Realized volatility in FX has tended to initially decline and then tick higher over the year leading up to the start of a recession
Median of VXY-weighted realized vol around the start of NBER recessions



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Vol alpha in an upbeat growth environment

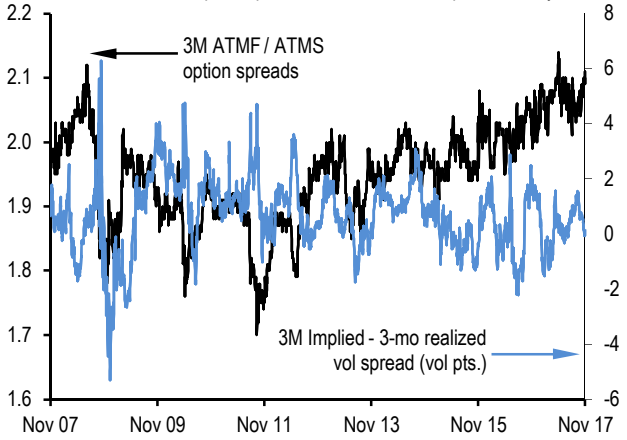
- **Earning option-based carry via ATMF / ATMS option spreads:** The two main streams of non-directional alpha available to FX option investors are earning vol premia by selling options or harvesting yield in forward points by buying ATMF options or ATMF vs. ATMS option spreads in the direction of positive carry. An earlier publication this year explored the similarities and differences in the return profiles of the two strategies as well as their efficacy in different vol environments, and concluded that the current regime of low volatility and elevated carry / vol ratios favors option based carry constructs as the principal alpha source. That inference still remains valid seeing how *ex-ante* gearing of option-based carry trades has risen to near 10-yr highs, while implied – realized vol spreads in short-tenor options that have collapsed to near-zero (chart 6). Table 1 reproduces the regime analysis from the above referenced note, and demonstrates that the capped loss format of option-based carry generates positively skewed returns in environments similar to the present one vis-à-vis the negative skewness of short straddles, without any reduction of Sharpe ratios.

  A directional view agnostic selection of carry trades at current market would include TWD/INR, EUR/TRY, EUR/CNH and EUR/INR. On a discretionary basis, **EUR/CNH** is our most favored pick of these since (a) it is insulated from broad dollar noise; (b) it loosely mimics the CNY CFETS basket on account of the material (16%) weight of the Euro in the index, and an overall constructive take on the RMB translates into a soft bearish view on EUR/CNH; and (c) EUR/CNH is one of the most correlated Euro-crosses to EUR/USD in large Euro declines, hence selling the cross is not only consistent with the JPM baseline of a mild dip lower in EUR/USD towards 1.14 in 1Q18, but also hedges against an abrupt and unexpected widening of Italian political risk premium next year. Our inclination is to avoid TRY and INR crosses at this point given the weight of pre-existing spec longs in those markets intersecting with an oil rally driven widening of C/A deficits.

  Even though they do not necessarily screen as the best buys on pure carry grounds, we also favor legging into **high-yielding petro-currencies** that have decoupled from the recent run up in oil prices and are due a catch up. **EUR/RUB** is our preferred pick in this bloc: as a current account positive oil exporter, RUB should be the cleanest FX beneficiary of a bullish shift in oil prices; positions are and valuations cheaper after the recent bout of weakness; our EMEA team is fundamentally OW the currency; and carry / premium ratios is EUR/RUB ATMF/ATMS put spreads comfortably outstrip those in USD/RUB.

Chart 6. Milking carry in forward points via options is a more appealing alpha prospect next year than selling volatility based on *ex-ante* risk premia on offer

Ex-ante risk premia in traditional vol selling measured as 3M implied vol – trailing 3-mo realized vol, and in option-based carry as the maximum payout / premium ratio of ATMF vs. ATMS option spreads in the direction of positive carry



Source: J.P.Morgan

Table 1. The current environment of low volatility and high carry / vol ratios leads to better *ex-post* risk-adjusted returns from long carry option strategies than straddle selling

Quarterly returns from short volatility and long carry option strategies stratified by historical percentiles of the level of volatility (X-axis) and the carry / vol ratio of a global FX carry basket (Y-axis). Each strategy rebalances a basket of top 4 USD pairs based on the 3M implied - realized vol spread for short vol and maximum payout / cost ratio for ATMF / ATMS option spreads and holds 3M options (delta-hedged straddles and ATMF / ATMS spreads) to maturity. Includes 8bp transaction costs, for details, see *Option based carry and short straddles imperfect substitutes but worthy complements*, Jankovic et al, 13 June 2017.

Percentile of 3M carry/vol ratio of global FX carry basket		0-33 Short straddles	0-33 ATMF vs. ATMS carry	33-66 Short straddles	33-66 ATMF vs. ATMS carry	66-100 Short straddles	66-100 ATMF vs. ATMS carry
66-100	# of obs	*29*		*22*		*9*	
	Avg.Ret	2.9%	2.5%	3.0%	4.7%	-6.2%	-2.6%
	IR	1.9	1.9	2.4	2.0	(1.4)	(2.2)
	Skew	(0.9)	1.1	(0.0)	0.9	(0.9)	(0.0)
	Kurtosis	0.7	1.3	(1.0)	0.5	(0.4)	(1.7)
33-66	# of obs	*24*		*27*		*10*	
	Avg.Ret	3.7%	1.3%	1.7%	0.9%	-2.7%	0.1%
	IR	3.2	1.2	0.8	0.7	(1.4)	0.0
	Skew	(0.9)	(0.3)	(2.6)	0.2	(0.6)	0.3
	Kurtosis	0.5	(0.7)	6.4	(0.8)	(1.0)	(1.5)
0-33	# of obs	*8*		*12*		*41*	
	Avg.Ret	4.4%	1.1%	4.3%	0.2%	3.4%	0.5%
	IR	4.2	0.8	4.3	0.2	1.2	0.3
	Skew	(0.7)	0.7	(0.3)	0.1	(1.6)	(0.1)
	Kurtosis	(1.1)	(0.5)	(0.4)	(0.6)	2.5	0.1

Historical percentile of VXY Global

Source: J.P.Morgan.

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Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

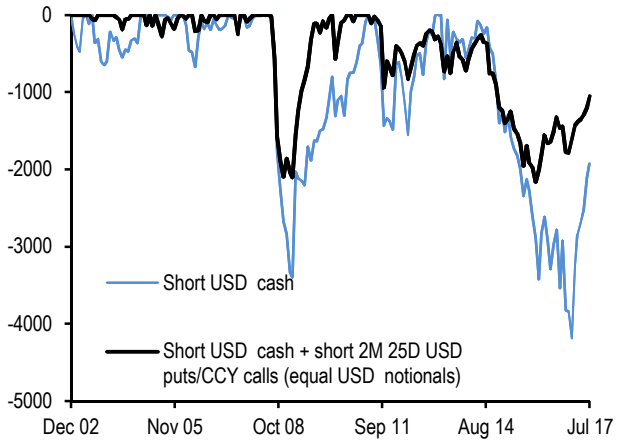
— Buy 6M ATMF vs. ATMS EUR put/CNH call spread @ indic. vols 6.65/7.0 vs. 6.75 ch, off spot ref 7.8305

— Buy 6M ATMF vs. ATMS EUR put/RUB call spread @ indic. vols 13.0/13.45 vs. 12.25 ch, off spot ref. 69.8535

One twist on ATMF / ATMS spreads on traditional high-yielders vs. USD, EUR or JPY is to consider antipodean FX, especially **AUD** as the funding leg. There are at least three potential benefits to this approach. First, selling AUD is consistent with our directional view for next year (see the antipodean section of this publication), with little/no additional yield disadvantage vis-à-vis the USD. Second, AUD-crosses should be be more resilient to the ebb and flow of systemic drivers like Fed pricing and hence monetize pure rate differentials more reliably. And third, the generally high correlations between high-beta currencies means that AUD-cross options should be cheaper than USD or EUR pairs, although some or all of this correlation advantage could be whittled away by bid-offer costs. Liquidity permitting, AUD/CNH, AUD/INR, AUD/BRL and AUD/MXN are all carry candidates worth pursuing.

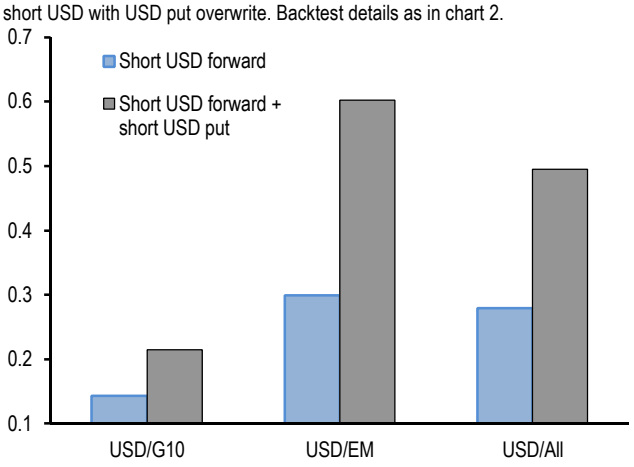
- **Call overwriting on cash FX carry:** One workaround around the VaR challenge of selling volatility at current levels is to **overwrite short-dated (1M-3M) OTM USD puts on cash short dollar/long carry portfolios** as a way of retaining exposure to continued upside in growth assets while collecting some handy premium in the process. Indeed, charts 7 and 8 show that USD put overwriting has been a useful risk-reduction strategy for short dollar portfolios over time, even if they have not necessarily proven to be return enhancers in the mold of equity calls. USD put overwritten short dollar portfolios have historically experienced an improvement in average return/drawdown ratios of between 50% - 100% vis-à-vis cash dollar shorts depending on the currency universe, with benefits most acute for EM FX that are most equity-like in terms of vol risk premium, and where the heavy hand of central bank intervention often constrains runaway currency appreciation. Beyond this empirically demonstrated efficacy of overwriting strategies, two factors in particular recommend their use next year. First, the stark difference in the dollar's positioning set-up heading into 2018 vis-à-vis 2017 means that a repeat of this year's outsized EM returns – at least the significant short-covering driven portion thereof – appears unlikely. This in turn reduces the odds of missing out on large, right tail currency rallies that call overwriting by its very nature prevents participation in. Second, one of the most noticeable developments on vol surfaces as a result of this year's dollar bear trend has been the sharp compression of risk-reversals. This means that USD puts are the most expensive that they have been relative to USD calls in a long time, implying that there is a genuine RV edge to selling them for yield enhancement purposes.

Chart 7. Overwriting USD puts on cash USD shorts tends to markedly improve the drawdown profile of short dollar portfolios…
Drawdowns (bp USD) of average annual return equalized P/L streams of i) equally weighted portfolio of short 2M USD forwards vs. a basket of G10 and EM currencies; and (ii) same cash short USD portfolio + short 2M 25D USD puts/CCY calls in equal USD notionals. Forwards and options in all cases held for a month and rolled monthly. Assumes no transaction cost on forwards, and constant 0.3 and 0.5 mid-to-bid vol charges on G10 and EM options respectively. Monthly data since 2002.



Source: J.P.Morgan

Chart 8….especially for short USD/EM portfolios
Average annualized return / average drawdown ratios of cash short dollars and short USD with USD put overwrite. Backtest details as in chart 2.



Source: J.P.Morgan

- **Owning long-end, low delta, carry-friendly convexity:** A suite of long carry or premium earning positions is well supplemented with longer-dated, low-delta calls on asset currencies that are decay friendly yet provide positive convexity to the potential for a substantial rally should cyclical conditions turn out much better than anticipated. The two most promising currency blocs to own such options in are **yen crosses** (yen puts) and **petro-currencies** (oil FX calls). The appeal of the former is that outsized yen weakness that catapults all yen-crosses higher is not difficult to envision should JPMorgan's punchy four Fed-hike call in 2018 fructify even as the

Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

BoJ effects only minor tweaks to its yield curve control framework, and given the technical backdrop of dealer books needing to net buy vol north of the 120-125 zone in USD/JPY that can exacerbate spot moves as vol-supplying Japanese importer structures approach or trigger knock-out barriers. The oil theme plays into the ongoing disconnect of oil currencies with crude prices, and seeks to take advantage of any non-linear shift in oil market psychology – the return of consumer hedging after years of absence for instance – should some mix of stronger-than-expected demand growth, supply outages (e.g. Venezuela) or production shortfall (shale), and geopolitics (Saudi/Iran) spark a sharp spike in prices. For option buyers, the common feature of yen crosses and petro-bloc FX that is of interest is that they contain high-yielding candidates that can mitigate the cost of carry. Ideally, one would like to use as low delta and long-dated options as liquidity permits in order to maximize fly sensitivity while minimizing bleed. Table 2 shortlists a set of such options that satisfy arbitrary value and carry criteria; the following two trades strike us as decent mix:

- *2Y 10D BRL calls/JPY puts are offered @ indic. vols 13.5/14.5 (14.0 mid)*
- *2Y 10D EUR puts/RUB calls are offered @ indic. vol 12.65/13.65 (12.78 mid)* 2Y expiries are in deference to liquidity constraints in RUB options.

Hedges for the consensus bull being wrong-footed

Portfolios resetting for the new year will inevitably need to buy some volatility at current levels in the interest of risk management prudence, even if modal views are resolutely bullish. We explore two different ways of approaching the problem -- a rule based heuristics applied to long vol instruments of different flavors and a set of discretionary defensive recommendations. A special section on systematic straddle buying follows after.

1. **Systematic long volatility by selling double no-touches (DNTs):** In theory, selling barrier options i.e. being *long* knockout risk should be a useful complement to vanilla long vol strategies since it does not rely on large market eruptions to be successful, even small (and increasingly frequent) intra-day gap moves in spot beyond barrier levels should suffice. Selling double no-touch (DNT) options in particular also carries the additional attraction of taking the other side of the dominant leveraged investor flow that predominantly tries to buy such instruments to sell volatility with high leverage and in capped loss format. For this note, we backtested the efficacy of systematically selling 4-week DNTs across a range of prices and various universes of currencies (G10, EM etc), conditioned on simple metrics of drift and noise – the two intuitive enemies of barrier options. Our findings are as follows:

Table 2. A selection of low/positive bleed long-dated low delta options

Shortlist criteria: 2-yr zscore of premium <=-0.75 and 1-yr carry / premium >=0.2. No transaction costs

Pair	Option Type	Tenor	Spot	Delta	Strike	Vega	Premium (bp asset)	Vol-For-Strike	2-yr Z-score of Premium	1-yr premium carry (bp asset)	1-yr carry / premium ratio
BRL/JPY	**Call**	**4Y**	**34.44**	**10**	**36.47**	**23**	**87**	**14.2**	**-1.0**	**27**	**0.31**
EUR/ZAR	Put	5Y	16.70	10	16.19	35	175	17.3	-1.0	17	0.10
EUR/INR	Put	5Y	76.87	10	77.88	34	110	10.7	-1.4	9	0.08
EUR/RUB	**Put**	**4Y**	**70.22**	**10**	**65.31**	**33**	**132**	**14.3**	**-1.0**	**-13**	**-0.10**
EUR/PLN	Put	5Y	4.24	10	3.86	33	87	8.1	-0.9	-9	-0.11
NZD/JPY	Call	5Y	77.34	10	89.45	33	101	10.7	-1.6	-11	-0.11
EUR/NZD	Put	5Y	1.72	10	1.51	32	109	10.6	-1.3	-12	-0.11
USD/BRL	Put	3Y	3.28	10	2.90	26	104	14.0	-1.1	-12	-0.11
USD/INR	Put	5Y	65.29	10	60.25	25	89	9.7	-1.0	-11	-0.12
USD/ZAR	Put	5Y	14.18	10	11.83	33	165	18.5	-0.9	-21	-0.12
AUD/JPY	Call	5Y	85.66	10	102.15	32	106	10.9	-1.4	-16	-0.15
EUR/NOK	Put	5Y	9.66	10	8.29	33	85	8.1	-1.2	-14	-0.17
EUR/CNH	Put	5Y	7.81	10	7.20	31	108	10.4	-1.1	-20	-0.18
EUR/AUD	Put	5Y	1.55	10	1.34	33	105	10.2	-1.2	-20	-0.19

Source: J.P.Morgan

- The expected value of blindly buying or selling DNTs across a broad currency universe is close to zero after factoring in realistic transaction costs. This is an encouraging result for vol buyers/DNT sellers who generally expect significantly negative average returns due to theta bleed. But it should worry DNT buyers since any vol selling strategy, however naïve, ought to generate positive returns over long histories – selling delta-hedged straddles certainly does in every asset class. That buying DNTs does not attests to either the efficiency of the FX option market in pricing discontinuity risk, or any systematic edge in vol selling being whittled by the significant transaction costs that these options entail.
- EM currencies are more amenable to frequent barrier triggers than G10 pairs. Within the G10 universe, DNTs in USD pairs are more prone to getting KO'd than in non-USD crosses.
- Selling low price DNTs in the 20% range i.e. settling for 1:5 gearing delivers better Sharpe Ratios than higher price options. Such a ploy is counter-intuitive from a long volatility investing standpoint, but the pattern of frequent small returns even outside of financial crashes renders the return stream a useful diversifier for other more traditional defensive strategies.
- Conditioning currency selection on drift and noise metrics is vital to performance. Chart 9 shows that the short DNT return stream of a portfolio of top 3 EM currencies ranked by a 50:50 blend of a classic trend strength indicator (14-day ADX) and 1-mo realized / 1M implied vol ratios handsomely outperforms naïve selections. Additional research to test a larger set of option tenors and factor variables is in order, early results are promising and particularly germane to macro portfolios that are long of EM assets and in search of diversifiers. At current market, the heuristic suggests

Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

selling an equally weighted basket of DNTs in TRY, MXN and ZAR.

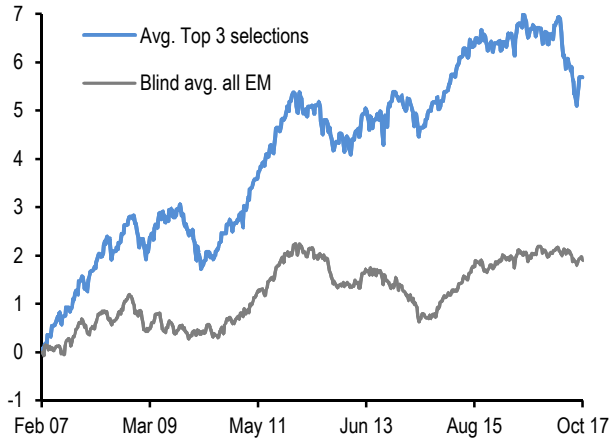
2. Discretionary long volatility ideas:

- *1Y1Y USD/JPY forward volatility (FVAs)*: It is common knowledge now that heavy vega supply from Japanese importers that have lowered and flattened the yen vol surface to near pre-GFC lows. Owning yen vol from these levels is an all-weather hedge that offers protection against geopolitical stress, an equity market correction, and a material US bond market sell-off that raises the volatility of long-end USD/JPY forwards. The technical angle to the long yen vega trade is the dealer positioning in long-dated exotic yen structures: legacy PRDC risk is still expected to sustain the well-established negative spot-vol link of yesteryears if spot were to fall near to or below 100, while knockout barriers in more recent vintage importer structures in the high 120s/low 130s in spot should trigger a need for exotics book to cover vega shorts if spot inches closer to those levels. Admittedly, this is a wide spot range to breach for yen volatility to kick in forcefully, but one could argue that subdued currency behavior is more than priced into current implied levels. The flatness of the long-dated yen vol curve (chart 10) motivates 1Y1Y forward volatility (FVA) structures that incur low/no carry along the term structure.

- 6M6M EUR/GBP forward volatility (FVAs): The fundamental case for owning GBP volatility is straightforward and colored by uncertainty on multiple fronts – around the Brexit process, increasingly dysfunctional domestic politics, continued debate around the abrupt change in the BoE's reaction function and the risk of a sharp unwinding of the 100bp of rate hikes priced along the yield curve should growth and/or politics intercede. Yet current levels of GBP implied vols / skews are below pre- referendum levels from last year, and are consistent with zero risk premium in spot above and beyond pure rate-differential based pricing. Given the unpredictable timing of the twists and turns in the UK policy story, we favor low bleed, longer-dated vol structures such as 6M in 6M EUR/GBP forward volatility (6M6M FVA), which incurs minimal (0.3 vols on mid) slide along a flat vol curve, is marginally (~0.5 vol) cheap on an RV basis versus equivalent GBP/USD structures, and has the additional kicker of participating in any Euro-related volatility brought about by either a more aggressive than expected ECB taper or resurgence of Italian election risk premium.

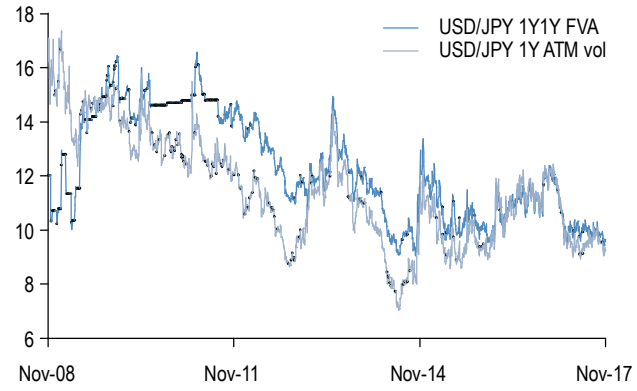
Chart 9. *Selling* low premium double no-touches (DNTs) in EM currencies is an atypical long volatility strategy with positive expected value if conditioned on simple metrics of drift and noise

Cumulative returns ($mn) from a strategy of selling 4-wk 20% price DNTs in USD/EM pairs with barriers equidistant from spot, and holding to the earlier of expiry or knock-out. The strategy selects a basket of 3 currencies on every rebalancing date that rank at the top of a composite drift + noise metric. Drift is measured using a 14-day ADX indicator, while noise is measured as the 1-mo realized / 1M ATM vol ratio; the composite indicator uses the average ranking of currencies on each metric. Assumes $1mn payout of DNTs equally split among the 3 currencies at every roll, and 2% transaction cost from mid. Barrier knock-out conditions checked using daily high / low data from Bloomberg.



Source: J.P.Morgan, Bloomberg

Chart 10. Low and flat USD/JPY vol curves motivate 1Y1Y FVAs as an all-weather portfolio hedge



Source: J.P.Morgan

- USD/TRY long-dated (2Y-5Y) straddles: Few would quibble with the fundamental case for vol ownership in TRY after recent developments. Our EMEA analysts are of the view that even after recent lira weakness, markets have not found a stable equilibrium -- without rate hikes as a circuit breaker, the currency could weaken substantially. Additionally, bond portfolio outflows are yet to materialize and remain a significant risk, especially with positioning across Turkish assets near multi-year

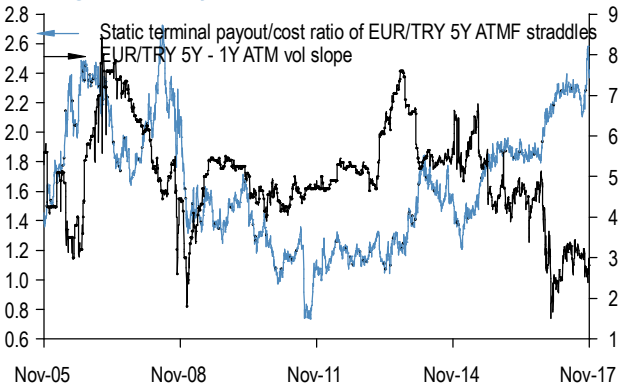
Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

highs. Yet as we have flagged in the past, FX vols have lagged the re-pricing in Turkish rates and FX, and that this muted vol response has resulted in carry / vol ratios in TRY options rising to stratospheric levels reminiscent of the pre-Lehman'08 period (chart 11). While true for TRY options of all tenors, the set-up is more extreme for longer-dated options which in any case have a general proclivity towards higher carry / vol ratios. EUR/TRY options are turbo-charged versions USD/TRY, since their near-identical implied vol levels do not adjust for wider forward points in EUR/TRY on account of negative European yields. Even setting aside high implied yields for a moment, there is a vanilla RV case for preferring to own longer-end TRY options over shorter-dated ones predicated on the near-extreme flatness of the option surface (chart 11), which is another option pricing given the prevalence of high interest rates.

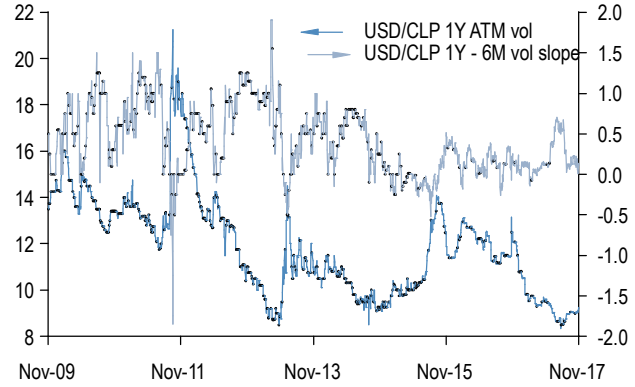
- Long -6M/+1Y calendar spreads in USD/CLP: CLP is a recent underweight recommendation from our LatAm team on poor valuations and negative balance of payment dynamics (see note). Selling CLP also entails minimal interest rate carry, and its relative liquidity within the Latin region offers potential for the currency to be increasingly used as a proxy hedge against higher-yielding investments in the region should risk sentiment deteriorate. There is no premium in the vol surface any hint of risk aversion however: not only are vols at multi-year lows and the curve flat (chart 12), but so are risk-reversals, flies and their term structures. Realized vols have persistently under-performed implieds however, hence this surface is tailor made for forward volatility structures. Given the illiquidity of FVAs however, our preferred construct is a short 6M ATM straddle vs. long 1Y 25D strangle calendar spread (delta-hedged) @9.4ch vs. 9.4/9.85 indic vols that takes advantage of both curve shape and depressed fly / ATM ratios.

Chart 11. Carry / vol ratios in long-dated TRY options have climbed to near pre-2008 all-time highs, and they are also more attractive to own along a historically flat vol surface



Source: J.P.Morgan

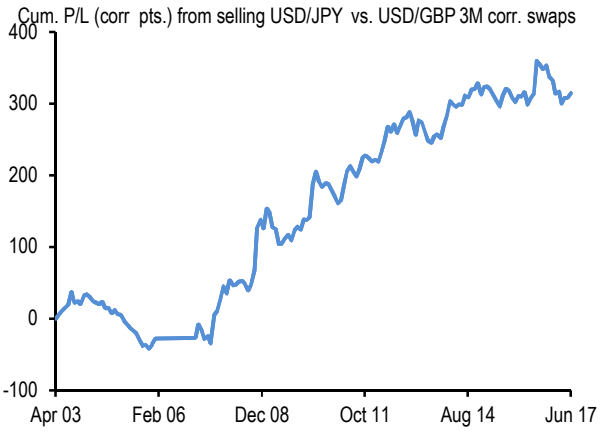
Chart 12. There is no hint of risk premium on the CLP vol surface, with vols at post-GFC lows and curves flat



Source: J.P.Morgan

Chart 13. In principle, selling GBP vs. JPY correlation is the correct systematic stance

Cumulative returns (corr pts.) from systematically selling 3M expiry USD/JPY vs. USD/GBP correlation swaps (WMR fixes and holidays), no transaction costs.



Source: J.P.Morgan

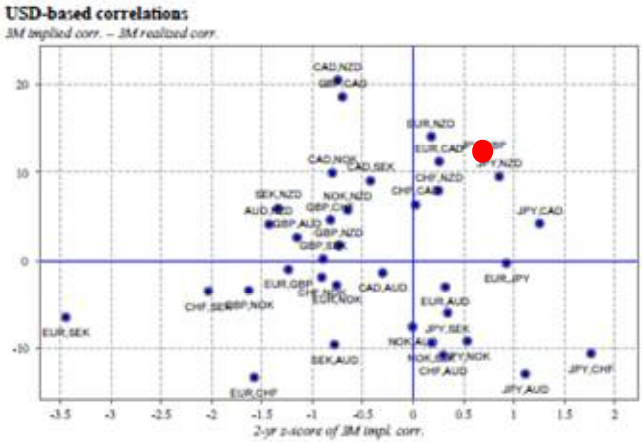
- Short GBP vs. JPY 1Y correlation: The principal motivation for a short GBP vs. JPY correlation stance is to benefit from idiosyncratic UK-related uncertainty that is likely to have only limited spillover onto other currencies per the Brexit aftermath template. GBP /JPY is especially interesting for three reasons: (a) as traditional asset and funding currencies, de-correlation is the norm rather than the exception for the pair; chart 13 shows that a hypothetical strategy of systematically selling GBP/USD vs. JPY /USD correlation swaps would have generated high Sharpe Ratio returns (excluding transaction costs, hence hypothetical) over a long history spanning multiple volatility cycles; (b) the yen has the potential to decouple from the rest of the majors if either international trade or North Korean tensions rise, if the BoJ's YCC re-set turns out to be a bigger market event than we currently expect, or if the delivery of four Fed

Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

hikes next year sparks a sharp lurch higher in USD/JPY into the 120s that then gathers a life of its own as exotic option effects exacerbate the trend; and (c) GBP vs. JPY currently screens as a relatively expensive correlation with trailing 3-mo realized corrs clocking 10 points under implieds (chart 14), hence the tactical set-up aligns with the strategic case for a short.

Chart 14. GBP vs. JPY correlation screens rich



Source: J.P.Morgan

Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

Special Topic: Systematic long vega using straddles

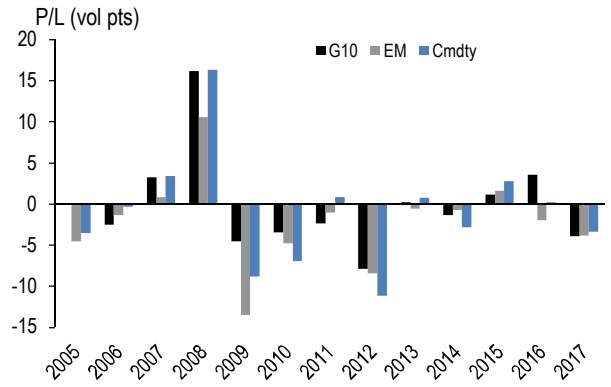
The inherent uncertainty in the timing of risk events and consequently the penalty for carrying long option positions (particularly EM options) often offsets gains from infrequent but potent back-end vol and forward point explosions during high-intensity shocks. We investigate if rule based long vega rotation across USD/G10 & EM i.e. sorting the FX universe by a certain conditioning variable and buying vol in the top decile of currencies for that factor is able to deliver attractive returns during such shocks and make long vega worth sustaining significant pain (3-5vol pts annually) from theta-decay in calm markets. We adopt a cross sectional approach because timing vol spikes is extremely difficult; for instance, a naïve timing strategy that keeps long vega exposure ON outside of VXY sell-offs helps to lift overall returns but fails to mitigate time decay penalty (chart 2).

Rule based long vega rotation across USD pairs - setup

Currency instruments: 1Y straddle longs were rotated across the universe of 9 G10 and 17 most liquid EM USD pairs (VXY-EM pairs in addition to USD/CLP, COP, MYR and ILS) by selecting the top (bottom) ranked entry based on indicators shown in Table 1. N of currencies in portfolio was set to 1, 3 or 5 (with N = 3 and 5 representing top decile and top quintile, respectively).

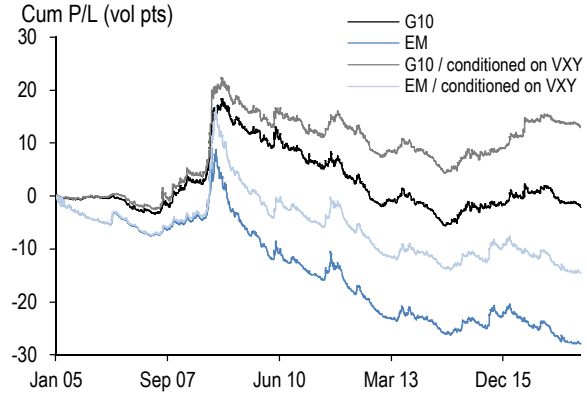
Signals and transformations: Signals used in the study can be broadly characterized as value gauges for selecting **1) "cheap" vol** (e.g. z-score of ATM, RR), **2) carry indicators to ease theta decay as well as to spot vulnerable overcrowding** (e.g. carry / premium ratio), **3) risk premium measures** (e.g. realized vol / ATM, vol curve, realized vol), 4) **flow pressures** (e.g. RR/ATM) and **4) current performance of spot exchange rates** (e.g. trend strength). Realized vol was calculated as 1-month trailing RMS volatility of 1Y forwards, and the trend strength indicator was defined as: $abs\left[\frac{(Current\ spot - 1M\ low)}{(1M\ high - 1M\ low)} - 0.5\right]$. The indicator reads "1" when on the top or the bottom of a 1-month range and "0" if right in the middle of the range. Raw variables were supplemented by1-year z-scores to normalize variables and put different currencies on same footing for comparison, ratios over ATM (with similar normalization purpose), and momentum measures such as Δ m/m and % Δ m/m. As part of robustness testing and in conjunction with momentum measures, we also used 1-month moving average (here MA being applied to the

Chart 1. Long vega hedging against surprises suffers significant P/L toll outside of non-high vol periods.
Cumulative P/L for baskets of 1Y straddles (VXY-G10 and VXY-EM weighted baskets in case of G10 and EM and equal weighted across commodity currencies for Cmdty basket). Delta hedged daily with forward smile delta. No transaction costs.



Source: J.P.Morgan

Chart 2. Naïve conditioning of long vega with VXY improves overall returns but leaves the vega trades vulnerable to calm markets.
VXY conditionality: participate only outside of VXY sell-offs (as measured by 1 sigma weekly declines on VXY) – i.e. not invested during VXY sell-offs, as signaled by weekly Δ in VXY to avoid being in the market during protracted vol sell-offs.



Source: J.P.Morgan

Table 1. Indicators tested for buying vega.
↑(↓) denoted buy vol in currency with highest (lowest) value of indicator.

signal	Raw	1-y zscore	Δ m/m [zscore]	Δ m/m		% Δ m/m	
					w/ MA		w/ MA
ATM vol		↓			↓	↓	↓
Realized vol						↑	↑
Realized vol/ATM	↑	↑					
Carry / premium		↑		↑		↑	
RR		↓			↓	↓	↓
RR/ATM	↓	↓					
BF/ATM	↑						
1Y - 3M vol curve	↓	↓	↓	↓	↓		
RR vol curve		↓					
1Y / 3M tenor ratio	↓						
spot trending	↑						

Source: J.P.Morgan

Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

underlying signal, e.g. ATM vol). While relevant in case of higher-frequency dynamic signals (e.g. gamma tenors), MA transformation exhibited mostly negligible impact on typically slowly changing 1Y vol tenors. Since the trend strength variable is stationary and bounded between 0 and 1, we use it only in the raw form.

Portfolio construction: Since the goal is to maximize risk-reward by maximizing P/L during the high-vol periods (GFC, Greece – 2010 and 2012, EMU in 2012, Taper during 2H13, USD rally at the start of 2015 and CNY deval in 2015) while minimizing bleed during calm markets, we assess trade signals performance by analyzing historical (2006-present) cumulative returns from holding long delta-hedged (forward delta smile) 1Y tenor straddles in currency pairs depicted by the trade signal.

Currency selections were refreshed every 3 months. The resulting problem of stale strikes was mitigated by considering three equally-weighted clips of 1Y options, with initiation and expiry schedules staggered by a month. In steady state therefore, a long vega strategy in any currency pair on any rebalancing date *t* consisted of three straddles – one opened that very day, one on day *t*-1m and one on day *t*-2m, with equal (1/3rd of total) notional vega weights on every clip.

Transaction costs: 0.3vol and 0.15vol transaction costs were applied for EM and G10 pairs, respectively, with the full brunt of transaction cost is accounted for at-initiation.

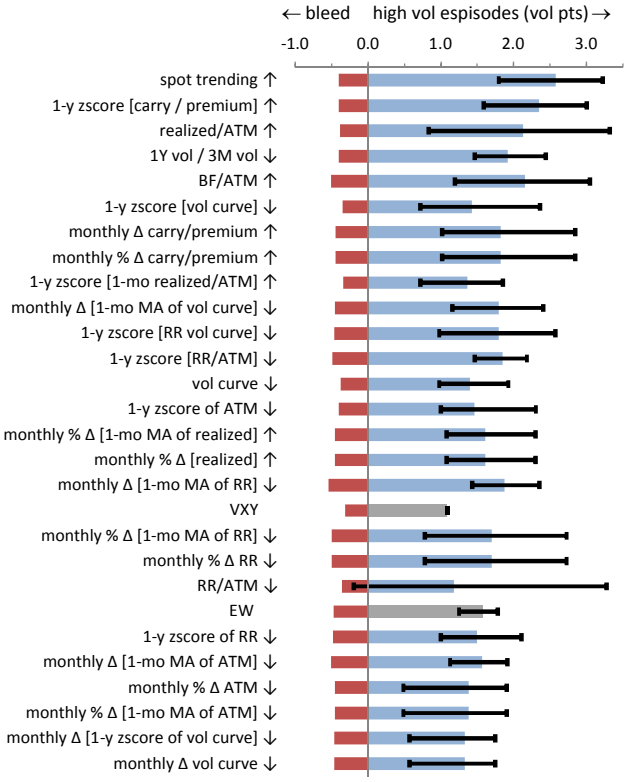
Robustness checks: Consisted of varying currency universe (G10+EM, EM only), number of currencies included in portfolio (the first decile, the first quintile) and roll frequency (3-mo, 2-mo). We also vary the backtest start date (2006-present, 2010-present), the later one excluding the outsized impact of the GFC on returns.

Rule based long vega rotation - results

Charts 4 and 5 report the effectiveness of individual signals in choosing long vega candidates. Chart 3 ranks all signals based on the risk-reward ratio – average returns during high-vol periods / average time decay losses, with P/Ls reported in vol pts/month. It also indicates the preferred direction of buying vol (currencies with the highest / lowest value of factor) and displays the average spread of high-vol returns (less downside being better). While certainly hitting the nail on the head with risk-reward ratios, chart 3 has some shortcomings. Namely, it obscures the fact that time decay may be pricey, as long as high-vol P/L is proportionally attractive (e.g. flies/ATM ratio signal). Lower conviction in anticipation of a high vol eruption would clearly try to avoid excessive time decay penalty. While Table 1 focuses on the decay/PnL ratio ranking,

Chart 3. Ratio of high-vol episodes to time decay favors 1) spot trend strength, 2) high carry-to-premium (z-score), 3) high realized/ATM vol and 4) flat / inverted 1Y-3M vol curve

↑(↓) denoted buy vol in curency with the highest (lowest) value of indicator. Average monthly time decay (in vol pts) during calm markets designated as "bleed". P/Ls averaged across various test scenarios (roll frequency, number of currencies, FX universe).Error bars represent max / min of the high-vol averages.



Source: J.P.Morgan

Chart 4 takes a more granular view by mapping the signals along high-vol P/L (x-axis) and time decay (y-axis) to more clearly delineate differences across the signals. Spot trend, 1-y zscore of carry-to-premium (CTP), realized vol/ATM ratio and 1Y/3M vol ratio come up favorably, while the metrics in Chart 4 discounts the value of flies/ATM and monthly % Δ in CTP.

Top performers: As previously identified *here* and re-confirmed by Chart 3 & 5, **high carry-to-premium ratios** of ATMF straddles is known to indicate potential vol buying opportunities, offering an attractive combination of prevailing low vol that could potentially mean-revert higher and/or elevated carry that partially offsets option time decay and permits patience in awaiting that mean-reversion. **High realized vol/ATM vol ratios** indicate ongoing stress that is yet to filter through to vega tenors. **Low 1Y-3M vol spread** reflects vol curve flatness that aids gentle roll-down and less painful time decay. The **trend strength of the spot rate** is

Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

the only non-option-based signal in the mix. Strongly trending spot likely signals a change in macro or technical conditions that could catapult spot into new / recently unchartered territory, spur demand for optionality from directional investors looking to participate in the trend, and also heighten realized volatility by knocking out barriers etc, all of which is vega positive.

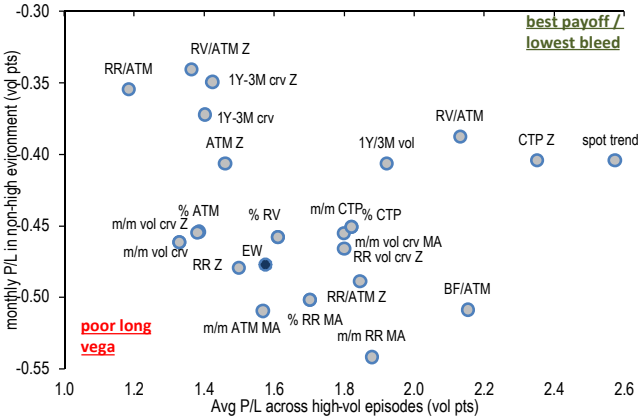
Laggards: Momentum signals and often used naïve signals such as z-scores of ATM vols underperform mostly due to less optimal time decay penalty. As we account for TC, piling into EM vs G10 doubles transaction costs from 6vol to 12vols over a ten year period.

Performance: Chart 5 shows return streams from the four of the best performing factors: 1Y-3M vol curve, CTP and trend strength of spot. Compared to an equally-weighted portfolio benchmark (blind selection), all four signals outperform by about 10-15vol during the 12 year sample of the backtest. On average, these strategies break even or make money if a high-vol episode occurs within a year from entering a systematic strategy. Given the low frequency of high-vol outbursts however, post-transaction cost expected value is still negative for even the best-performing factors, indicating the difficulty of the exercise as well as the need to house these return streams within an overall long beta portfolio as overlays. Encouragingly for vol buyers, the trend of consistent bleed has started to turn around in recent quarters, likely due to a combination of higher global volatility during the EM stress of 2015-16 and yields finally starting to inch higher after years of QE-led compression.

Q-score based composite signals

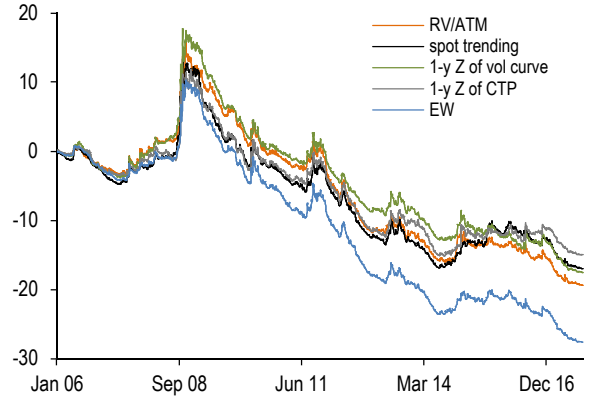
Minimizing time decay while maximizing returns by rotating currencies within a portfolio based on a single indicator succeeded in beating a blind benchmark but individual factors fail to fully offset transaction costs and time decay. This underscores our prior that the best one can hope for by systematically owning straddles portfolios is zero or slightly negative expected value with spikes during market turmoil. To move the needle in that ultimate direction, we explore composite signals (i.e. multiple signals simultaneously used in selecting currencies). The idea is that multi-factor selection criteria should be able to mine carry and risk build-up more efficiently and reduce high P/L misses. It also admittedly means that the selection may be less robust and may result in higher return volatility.
Multi-signal construction: While there are myriads of ways to combine multiple signals into a score (and none without pitfalls of selection ambiguities and/or spurious selection of underdogs) **we rely on Q-score**, which is more typical in stocks selection. If Xi, Yi, Zi etc. are the values of the signals X, Y and Z for the ith currency in a universe of N currencies (i.e. i = 1 to N), then a) normalize each conditioning variable for the ith currency across the

Chart 4. 1-y zscore [carry-to-premium ratio], spot trending and realized/ATM ratio signals stand out in line with the Table 1, but the metrics rules out BF/ATM ratio signal and places momentum signals in the unfavorable lower left area.



Source: J.P.Morgan

Chart 5. 1-y zscore [carry-to-premium ratio] and spot trending signal stand out as one of the best pay-off and lowest bleed candidates.
Currency section rebalanced every three months. EW designates equally weighted portfolio of overall currency universe, i.e. equivalent of "blind selection" benchmark. Cum P/Ls are average of three laddered portfolios. Delta-hedged daily by forward smile delta



Source: J.P.Morgan

currency universe as $x_i = [X_i - avg(X_1, X_2, \ldots X_N)]/stDev(X_1, X_2, \ldots X_N)$, and equivalently for signal Y and Z, and b) combine the X, Y and Z signals in a "composite" signal $w_1 x_1 + w_1 y_1 + w_1 z_1$ where the default for $w_1 = w_1 = w_1 = 1/3$. The normalization step sets different signals on the same footing and assures that no signal dominates purely on its intrinsic non-signaling properties, e.g. magnitude or range. Also note that the number of currencies in portfolio remains same (N = 1, 3 or 5 in our backtests).

Performance: Doing an exploratory mining exercise by building upon the base of the best individual performers

Arindam Sandilya
(65) 6882-7759
arindam.x.sandilya@jpmorgan.com

Ladislav Jankovic
(1-212) 834-9618
ladislav.jankovic@jpmorgan.com

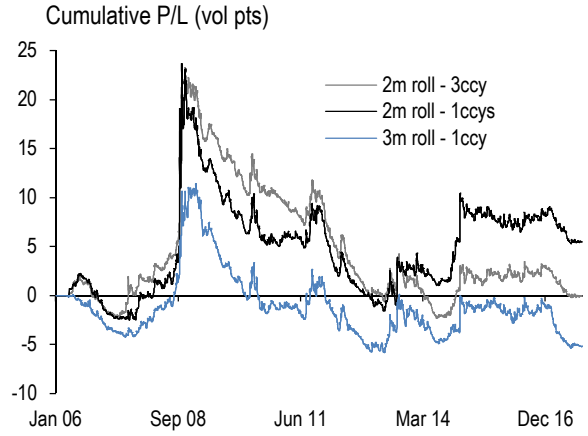
from the previous section to two and three signal combinations, we note that CTP and spot trending signal continue to dominate. Some of the weaker individual signals surface up (e.g. 1-y zscore of [realized / ATM vol ratio]), perhaps as they add more new information to the mix, having less overlap with the dominant signals: CTP and trend signal. In two factor space, a composite signal constructed with CTP z-score and RV/ATM z-score stands out, with almost no time decay drag on P/L over last 5 years. Z-score of 1Y-3M vol curve and trend signal mix also perform well with CTP z-score while RV/ATM ratio plus trend signal composite performs very well during high-vol episodes. Chart 6 shows cumulative P/L of **a composite signal constructed from three signals: Z score of CTP, trend strength of spot and Z score of realized/ATM vol ratio.** The return profile significantly improves on that from any of the individual signals in chart 5, especially in terms of P/L retentivity between sporadic shocks.

Robustness is the key concern with multi-factor signals. Our initial efforts show that the composite signal is robust on both our test variables – the number of currencies chosen and roll frequency. The signal does show propensity to outperform for smaller portfolios (e.g. N currencies = 1). As with individual signals, composite signals revert to "blind selection" performance as N of portfolio currencies increases.

Q-score signal current recommendations: Currently the top vega buys suggested by the combination of Z score of CTP, trend signal and Z score ratio [realized/ATM], the three components of the three-factor composite Q-score signal, are: **NOK, AUD and MYR.**

Chart 6. A composite factor comprised of 3 signals delivers the desired return profile during shocks with controlled bleed in the interim

Composite signal consists of: 1) of 1-y zscore [carry-to-premium ratio], 2) spot trending signal and 3) 1-y zscore [realized/ATM ratio]



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