

# Liquid Insight

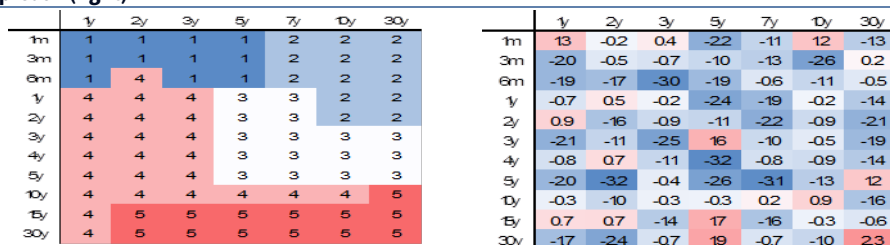
## Low for longer volatility

### Key takeaways

- Volatility is making multi-cycle lows. Our clustering model finds it cheap across the grid, although likely not a buy.
- The next best chance for a pickup in vol comes at the turn of the cycle as the Fed signals cuts and the curve bull-steepens.
- In the meantime, it is likely prudent to continue to position for carry while keeping hedges in place for higher rates.

### By Bruno Braizinha

Chart of the Day: Clusters on the implied volatility grid (left) and 3m z-scores using a clustered PCA approach (right)



Source: BofA Merrill Lynch Global Research

A low volatility environment has been a persistent feature of the market in recent years. As we make fresh multi-cycle lows the question needs to be whether there is an end in sight to this lull.

In this note we start by looking at the topology of the implied volatility grid through a clustering approach. Our results are in line with the general assumption for grid topology, suggesting five clusters that correspond roughly to the upper left and right corners in gamma space, cap and floor volatility (extending to 3y underlyings), and a vega sector split between intermediate and long vega (LRC). Although useful for bucketing and hedging of risk across the volatility grid, we use the approach here as a way of improving on standard RV metrics on the volatility grid.

Similarly to standard RV approaches, we find volatility cheap virtually across the grid in the clustering approach. However, we do not think it is a buy. The drivers for the low vol regime (which include the anchoring effect of low neutral rate expectations and the Fed put on risky assets) are likely to persist near term. The next best chance for a pickup in volatility across asset classes comes at the turn of the cycle as the Fed signals rates cuts and the curve dynamic transitions to bull steepening (more likely by mid-2020). In the meantime, it is prudent to continue to position for carry while keeping hedges in place for higher yields.

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## Topology of US volatility grid

The topology of the implied volatility grid is generally seen as containing several distinct sectors: upper left corner (ULC) and upper right corner (URC) in gamma space (expiries up to and including 1y), cap and floor volatility for expiries beyond 1y on the left side of the grid (underlyings up to 2y), and the vega sector, which is generally further subdivided into intermediate expiries (up to and including 5y expiries) and long vega in the lower right corner of the grid (LRC). Flows in these different sectors of the grid are generally dominated by different types of market participants. Intermediate expiries in the belly, for example, were in the past dominated by convexity hedging flows, while the dynamic of the intermediate and long vega sectors is generally driven by insurance and exotic hedging and Formosa issuance (see Exhibit 1).

**Exhibit 1: Some structural volatility end users and where they focus on the grid**

	Callable Flows		Convexity Hedging					
	1y	2y	3y	5y	7y	10y	30y	
1m	24.0	42.6	46.7	48.4	48.5	48.5	44.2	
3m	26.8	43.6	49.7	52.3	52.3	52.3	48.1	
6m	35.0	48.5	53.2	55.2	55.2	55.2	51.0	
1y	50.9	57.7	59.5	60.2	59.8	59.3	54.9	
2y	64.4	66.4	65.8	65.3	64.3	63.3	57.9	
3y	68.6	69.3	68.5	67.3	66.1	64.9	59.1	
4y	71.1	71.1	70.2	68.3	67.1	65.8	59.6	
5y	71.8	71.8	70.9	69.0	67.7	66.3	59.7	
10y	68.4	68.4	67.7	66.1	64.7	63.2	56.9	

Exotic Hedging Insurance Hedging

Source: BofA Merrill Lynch Global Research

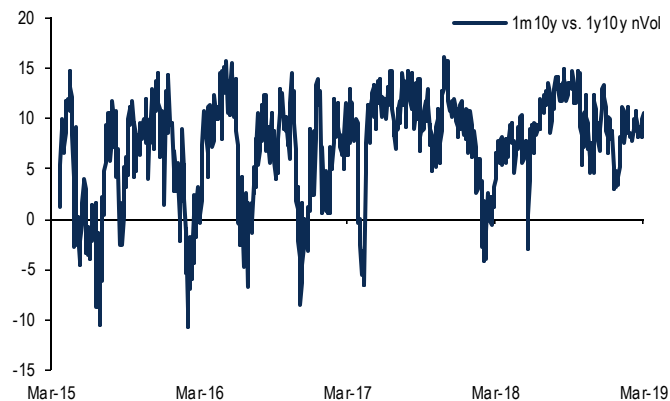
**Chart 1: 1y10y vs. 1y2y Normal Volatility**



Source: BofA Merrill Lynch Global Research, Bloomberg

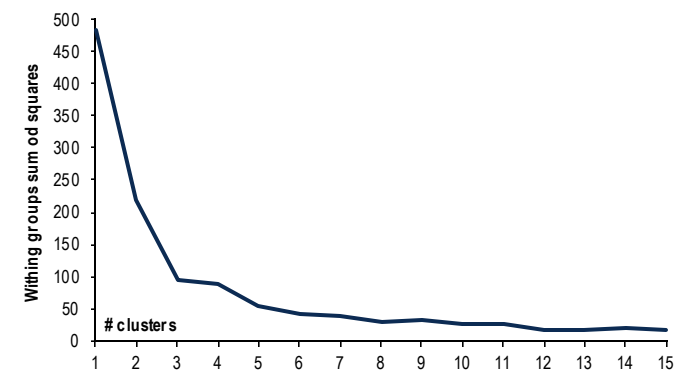
Beyond the flow component, the different sectors of the grid reflect changes in the dynamic of the yield curve across maturities. The ULC is obviously tied to Fed policy, with periods of outperformance versus the right side of the grid generally coinciding with buildup of optionality for the Fed, like we saw through most of 2018 (and vice versa for the recent dovish Fed tilt – Chart 1). Across expiries, the outperformance of gamma relative to intermediate expiries (and in cases inversion) is associated with periods of heightened risk, like the risk-off wave of late 2018 (Chart 2). Inversions in expiry curves tend to fade relatively quickly as a short gamma vs intermediate expiries position benefits from positive carry.

**Chart 2: 1y10y vs. 1m10y Normal Volatility**



Source: BofA Merrill Lynch Global Research, Bloomberg

**Chart 3: Decay of within group sum of squares for k-means clustering on the implied grid vs. number of clusters**



Source: BofA Merrill Lynch Global Research

The topology described above, the link to the curve dynamic and the behavior of structural end users of volatility all imply there should be strong correlations within the elements of these different sectors of the grid. One way to test for this is by applying a clustering algorithm to the volatility grid. In Chart 3, we use a k-means clustering approach on implied volatility data over the last year to look at the profile of the within-groups sum of squares vs the number of clusters. The results confirm the topology assumed above, as beyond 5-6 clusters the marginal benefit of adding another cluster to the analysis becomes quite small. More significantly, the clusters we obtain bear some resemblance to the general assumptions for the grid's topology (see Table 1). It is interesting, however, to note how different the topology of the delivered volatility grid seems to be from the one for the implied grid (Table 2).

**Table 1: Implied volatility clusters obtained by k-means clustering using 1y of data and assuming 5 clusters**

	1y	2y	3y	5y	7y	10y	30y
1m	1	1	1	1	2	2	2
3m	1	1	1	1	2	2	2
6m	1	4	1	1	2	2	2
1y	4	4	4	3	3	2	2
2y	4	4	4	3	3	2	2
3y	4	4	4	3	3	3	3
4y	4	4	4	3	3	3	3
5y	4	4	4	3	3	3	3
10y	4	4	4	4	4	4	5
15y	4	5	5	5	5	5	5
30y	4	5	5	5	5	5	5

Source: BofA Merrill Lynch Global Research

**Table 2: Delivered volatility (2m) clusters obtained by k-means clustering using 1y of data and assuming 5 clusters**

	1y	2y	3y	5y	7y	10y	30y
1m	1	1	1	1	2	2	4
3m	1	1	1	1	2	2	4
6m	1	1	1	1	2	2	4
1y	1	1	1	2	2	3	4
2y	1	1	2	2	3	3	4
3y	2	2	3	3	4	4	5
4y	3	3	3	4	4	4	5
5y	3	4	4	4	4	5	5
10y	5	5	5	5	5	5	5
15y	5	5	5	5	5	5	5
30y	4	4	4	4	4	4	4

Source: BofA Merrill Lynch Global Research

This type of approach may be useful for the bucketing and hedging of risk across the volatility grid. Here, however, we are more concerned with metrics of fair valuation, where these results may also be useful.

**Table 3: Implied grid 3m Z-Scores w/ PCA framework**

	1y	2y	3y	5y	7y	10y	30y
3m	0.9	1.7	1.7	0.2	-1.8	-1.5	-1.4
6m	-0.5	1.1	0.4	1.2	-0.5	-0.5	-0.7
1y	-0.7	0.3	0.0	-0.2	-0.1	-0.3	-1.6
2y	0.6	0.5	0.5	0.3	-0.6	-0.8	-3.0
5y	-2.0	-1.4	-1.4	-0.8	-0.7	-0.7	-1.2
10y	-0.3	0.2	0.0	-0.7	-0.6	-0.5	-0.2

Source: BofA Merrill Lynch Global Research

**Table 4: Implied grid 3m Z-Scores w/ PCA framework without directionality with rates**

	1y	2y	3y	5y	7y	10y	30y
3m	-0.3	-0.5	-0.6	-0.7	-0.7	-0.6	-0.5
6m	-0.6	-0.6	-0.6	-0.7	-0.6	-0.5	-0.5
1y	-0.8	-0.7	-0.7	-0.7	-0.7	-0.6	-0.6
2y	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.8
5y	-1.2	-1.1	-1.1	-1.1	-1.0	-0.9	-0.9
10y	-1.4	-1.3	-1.4	-1.6	-1.6	-1.5	-1.5

Source: BofA Merrill Lynch Global Research

The standard approach to RV analysis on the volatility grid is to use a PCA framework. In our Vol Views (see [here](#) and Table 3-4) we go one step further and attempt to remove the directionality between volatility and rates by regressing the main principal vectors of the volatility grid on principal components for the yield curve, and use the resulting model principal vectors in the inverse PCA transformation. There are a couple of shortcomings to this approach:

- It generally uses the first two or three principal components of the implied surface, which limits the description of the different rotation modes of the volatility grid
- It implies some tradeoff between the length of data used in the estimation and tolerance for noise. Longer windows lead to a more stable covariance estimation and results, but produce models that are less responsive to changing market conditions. Shorter windows imply some noise in the estimation and results.

Here we adopt an approach that may go some way to addressing these shortcomings. Instead of calculating principal components on the entire implied grid, we use the implied clusters identified above and calculate the principal components for each of these (ie, we reduce each cluster to two time series).

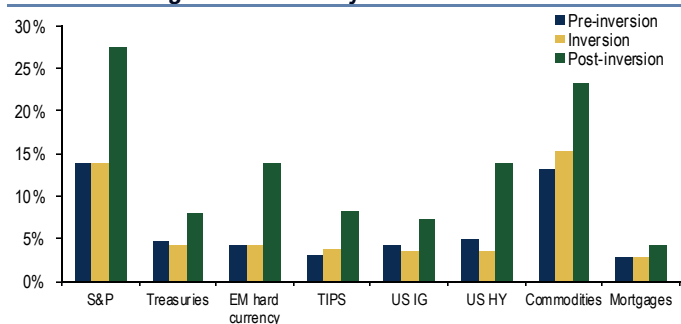
For each cluster, we regress its principal components on the principal components of the neighboring clusters, to capture the relative performance between clusters, and principal component of the forwards, to remove the directionality with rates. As we compute principal components on a smaller section of the grid, the approach tolerates smaller data sets and allows for a more granular RV analysis on the volatility grid. The results, shown in Table 5, confirm cheapness in volatility virtually across the grid, perhaps more pronounced in the belly of the grid.

**Table 5: 3m Z-scores using the clustered PCA approach**

	1y	2y	3y	5y	7y	10y	30y
1m	1.3	-0.2	0.4	-2.2	-1.1	1.2	-1.3
3m	-2.0	-0.5	-0.7	-1.0	-1.3	-2.6	0.2
6m	-1.9	-1.7	-3.0	-1.9	-0.6	-1.1	-0.5
1y	-0.7	0.5	-0.2	-2.4	-1.9	-0.2	-1.4
2y	0.9	-1.6	-0.9	-1.1	-2.2	-0.9	-2.1
3y	-2.1	-1.1	-2.5	1.6	-1.0	-0.5	-1.9
4y	-0.8	0.7	-1.1	-3.2	-0.8	-0.9	-1.4
5y	-2.0	-3.2	-0.4	-2.6	-3.1	-1.3	1.2
10y	-0.3	-1.0	-0.3	-0.3	0.2	0.9	-1.6
15y	0.7	0.7	-1.4	1.7	-1.6	-0.3	-0.6
30y	-1.7	-2.4	-0.7	1.9	-0.7	-1.0	2.3

Source: Merrill Lynch Global Research

**Chart 4: End in sight for the volatility lull?**



Source: BofA Merrill Lynch Global Research

### Volatility lull, is there an end in sight?

The above analysis confirms our pre-existing views for cheapness of volatility, particularly in the belly. However, we do not think this translates necessarily into a buying opportunity. A low volatility regime has been a persistent feature of the market in recent years, although somewhat difficult to explain when we note that it is coupled with richness of Treasuries in the late stages of the cycle. Indeed, our macro model for Treasuries implies a current 10yT fair value of 2.8% when one adjusts for the impact of the low global yield environment on the Treasury curve (see [here](#)). Treasuries are therefore trading rich by roughly 15-20bp at the backend of the curve. Although this is well in the context of the 37bp standard deviation of the model residuals, it starts to look more significant in the context of the current low volatility regime; the standard deviation of residuals for the last year was only 17bp.

Drivers for this contradiction include the perception of a Fed put on risky assets, which was enhanced by the dovish tilt at the January FOMC meeting, and the role of neutral rate expectations as an attractor for belly and backend yields in the late cycle stages, dampening volatility. Late in the cycle, these support a barbell approach to allocation, something we have noted in recent publications (see [here](#)).

There is likely an end in sight to this low vol environment. Indeed, we looked recently at the dynamic of volatility across asset classes in the late cycle stages and found volatility picks up meaningfully as the Fed signals rates cuts and the curve transitions from inversion to bull steepening (see [here](#)). The goal posts may be less clear in the current cycle, particularly since it is less likely to see a curve inversion under the current quasi-forward-guidance Fed stance. But interest in bull steepener and forward vol trades with horizons in 2020 seems to suggest a consensus around the 12-18m horizon for this structural change.

We therefore expect the recent volatility lull to persist near term. Interest is likely to continue to be tilted toward carry, and if the market dynamic over the last couple of weeks illustrated anything, it was the difficulty in moving away from this paradigm. The rates market is perhaps pricing the sum of all concerns, and there is certainly room for normalization, but it will take more than a few headlines to push us there this late in the cycle. Similarly to the broader barbell allocation stance, it is likely prudent to continue to position for carry while keeping hedges in place for higher yields.

## Notable Rates and FX Research

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- [Global Rates, FX & EM 2019 Year Ahead](#), 18 Nov 2018
- [Central bank policy unintended consequences](#), **Global Liquid Markets Weekly**, 11 Mar 2019
- [The strong USD](#), **Global FX Weekly**, 7 Mar 2019
- [Bunds and beans in the bunker](#), **Global Rates Weekly**, 8 Mar 2019
- [Brexit anxiety rising](#), **Liquid Cross Border Flows**, 11 Mar 2019

## Rates, FX & EM trades for 2019

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See [Global Rates, FX & EM 2019 Year Ahead](#)

For a complete list of our open trade recommendations, as well as our trade recommendations closed over the last 12 months, see:

[Global FX Weekly: The strong USD, 7 Mar 2019](#)

[Global Rates Weekly: Bunds and beans in the bunker, 8 Mar 2019](#)

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