Liquid Insight

Low for longer volatility

12 March 2019

Rates and Currencies Research
Global

Global Rates & Currencies Research
MLI (UK)

Bruno Braizinha, CFA
Rates Strategist
MLPF&S
+1 646 855 8949
bruno.braizinha@baml.com

Adarsh Sinha
FX Strategist
Merrill Lynch (Hong Kong)
+852 3508 7155
adarsh.sinha@baml.com

See Team Page for List of Analysts

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)

	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

	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: 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.

Recent Liquid Insight Publications

Timestamp: 12 March 2019 01:30AM EDT

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

Covexity Hedging

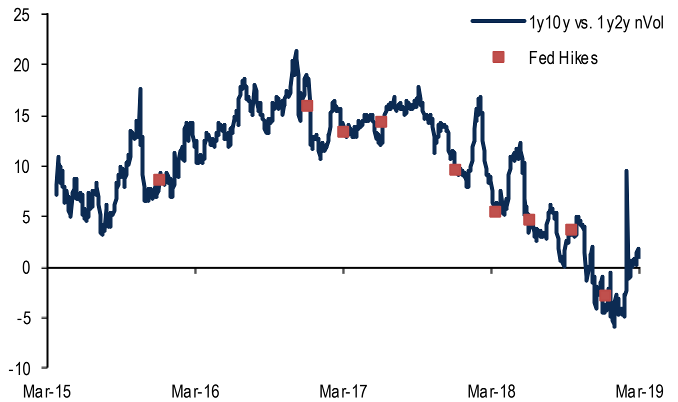
	1y	2y	3y	5y	7y	10y	30y
1m	24.0	42.6	46.7	48.4	48.5	48.5	44.2
3m	26.8	43.6	49.7	52.3	52.3	52.3	48.1
6m	35.0	48.5	53.2	55.2	55.2	55.2	51.0
1y	50.9	57.7	59.5	60.2	59.8	59.3	54.9
2y	64.4	66.4	65.8	65.3	64.3	63.3	57.9
3y	68.6	69.3	68.5	67.3	66.1	64.9	59.1
4y	71.1	71.1	70.2	68.3	67.1	65.8	59.6
5y	71.8	71.8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

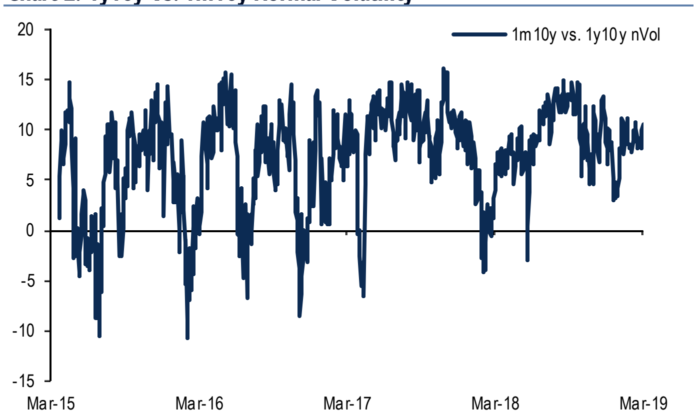
Chart 1: 1y10y vs. 1y2y Normal Volatility



Source: BofA Merrill Lynch Global Research, Bloomberg

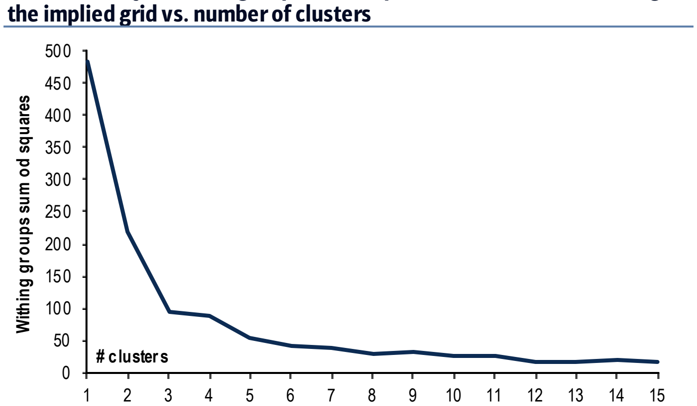
Beyond the flow component, the different sectors of the grid reflect changes in the dynamic of the yield curve across maturities. The ULC is obviously tied to Fed policy, with periods of outperformance versus the right side of the grid generally coinciding with buildup of optionality for the Fed, like 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).

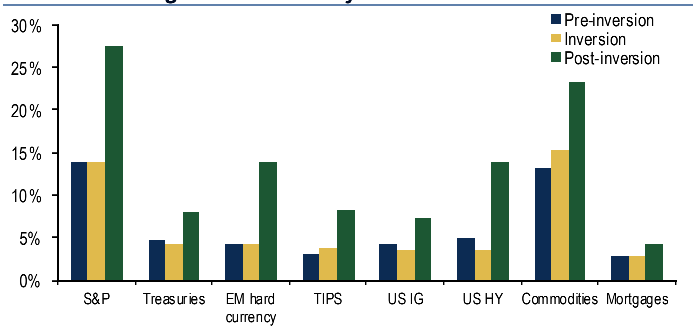
For each cluster, we regress its principal components on the principal components of the neighboring clusters, to capture the relative performance between clusters, and principal component of the forwards, to remove the directionality with rates. As we compute principal components on a smaller section 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

- 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

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

Disclosures

Important Disclosures

BofA Merrill Lynch Research Personnel (including the analyst(s) responsible for this report) receive compensation based upon, among other factors, the overall profitability of Bank of America Corporation, including profits derived from investment banking. The analyst(s) responsible for this report may also receive compensation based upon, among other factors, the overall profitability of the Bank's sales and trading businesses relating to the class of securities or financial instruments for which such analyst is responsible.
BofA Merrill Lynch fixed income analysts regularly interact with sales and trading desk personnel in connection with their research, including to ascertain pricing and liquidity in the fixed income markets.

Other Important Disclosures

Prices are indicative and for information purposes only. Except as otherwise stated in the report, for the purpose of any recommendation in relation to: (i) an equity security, the price referenced is the publicly traded price of the security as of close of business on the day prior to the date of the report or, if the report is published during intraday trading, the price referenced is indicative of the traded price as of the date and time of the report; or (ii) a debt security (including equity preferred and CDS), prices are indicative as of the date and time of the report and are from various sources including Bank of America Merrill Lynch trading desks.
The date and time of completion of the production of any recommendation in this report shall be the date and time of dissemination of this report as recorded in the report timestamp.

This report may refer to fixed income securities that may not be offered or sold in one or more states or jurisdictions. Readers of this report are advised that any discussion, recommendation or other mention of such securities is not a solicitation or offer to transact in such securities. Investors should contact their BofA Merrill Lynch representative or Merrill Lynch Global Wealth Management financial advisor for information relating to fixed income securities.
Rule 144A securities may be offered or sold only to persons in the U.S. who are Qualified Institutional Buyers within the meaning of Rule 144A under the Securities Act of 1933, as amended.
SECURITIES DISCUSSED HEREIN MAY BE RATED BELOW INVESTMENT GRADE AND SHOULD THEREFORE ONLY BE CONSIDERED FOR INCLUSION IN ACCOUNTS QUALIFIED FOR SPECULATIVE INVESTMENT.
Recipients who are not institutional investors or market professionals should seek the advice of their independent financial advisor before considering information in this report in connection with any investment decision, or for a necessary explanation of its contents.
The securities discussed in this report may be traded over-the-counter. Retail sales and/or distribution of this report may be made only in states where these securities are exempt from registration or have been qualified for sale.
Officers of MLPF&S or one or more of its affiliates (other than research analysts) may have a financial interest in securities of the issuer(s) or in related investments.
This report, and the securities discussed herein, may not be eligible for distribution or sale in all countries or to certain categories of investors.
BofA Merrill Lynch Global Research policies relating to conflicts of interest are described at https://rsch.baml.com/coi
"BofA Merrill Lynch" includes Merrill Lynch, Pierce, Fenner & Smith Incorporated ("MLPF&S") and its affiliates. Investors should contact their BofA Merrill Lynch representative or Merrill Lynch Global Wealth Management financial advisor if they have questions concerning this report or concerning the appropriateness of any investment idea described herein for such investor. "BofA Merrill Lynch" and "Merrill Lynch" are each global brands for BofA Merrill Lynch Global Research.
Information relating to Non-US affiliates of BofA Merrill Lynch and Distribution of Affiliate Research Reports:
MLPF&S distributes, or may in the future distribute, information of the following non-US affiliates in the US (short name: legal name, regulator): Merrill Lynch (South Africa): Merrill Lynch South Africa (Pty) Ltd., regulated by The Financial Service Board; MLI (UK): Merrill Lynch International, regulated by the Financial Conduct Authority (FCA) and the Prudential Regulation Authority (PRA); BofASE (France): BofA Securities Europe SA is authorized by the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers (AMF); BAMLI DAC (Milan): Bank of America Merrill Lynch International DAC, Milan Branch, regulated by the Bank of Italy, the European Central Bank (ECB) and the Central Bank of Ireland (CBI); Merrill Lynch (Australia): Merrill Lynch Equities (Australia) Limited, regulated by the Australian Securities and Investments Commission; Merrill Lynch (Hong Kong): Merrill Lynch (Asia Pacific) Limited, regulated by the Hong Kong Securities and Futures Commission (HKSFC); Merrill Lynch (Singapore): Merrill Lynch (Singapore) Pte Ltd, regulated by the Monetary Authority of Singapore (MAS); Merrill Lynch (Canada): Merrill Lynch Canada Inc, regulated by the Investment Industry Regulatory Organization of Canada; Merrill Lynch (Mexico): Merrill Lynch Mexico, SA de CV, Casa de Bolsa, regulated by the Comisión Nacional Bancaria y de Valores; Merrill Lynch (Argentina): Merrill Lynch Argentina SA, regulated by Comisión Nacional de Valores; Merrill Lynch (Japan): Merrill Lynch Japan Securities Co., Ltd., regulated by the Financial Services Agency; Merrill Lynch (Seoul): Merrill Lynch International, LLC Seoul Branch, regulated by the Financial Supervisory Service; Merrill Lynch (Taiwan): Merrill Lynch Securities (Taiwan) Ltd., regulated by the Securities and Futures Bureau; DSP Merrill Lynch (India): DSP Merrill Lynch Limited, regulated by the Securities and Exchange Board of India; Merrill Lynch (Indonesia): PT Merrill Lynch Sekuritas Indonesia, regulated by Otoritas Jasa Keuangan (OJK); Merrill Lynch (Israel): Merrill Lynch Israel Limited, regulated by Israel Securities Authority; Merrill Lynch (Russia): OOO Merrill Lynch Securities, Moscow, regulated by the Central Bank of the Russian Federation; Merrill Lynch (DIFC): Merrill Lynch International (DIFC Branch), regulated by the Dubai Financial Services Authority (DFSA); Merrill Lynch (Spain): Merrill Lynch Capital Markets Espana, S.A.S.V., regulated by Comisión Nacional del Mercado De Valores; Merrill Lynch (Brazil): Bank of America Merrill Lynch Banco Multiplo S.A., regulated by Comissão de Valores Mobiliários; Merrill Lynch KSA Company: Merrill Lynch Kingdom of Saudi Arabia Company, regulated by the Capital Market Authority.
This information: has been approved for publication and is distributed in the United Kingdom (UK) to professional clients and eligible counterparties (as each is defined in the rules of the FCA and the PRA) by MLI (UK), which is authorized by the PRA and regulated by the FCA and the PRA - details about the extent of our regulation by the FCA and PRA are available from us on request; has been approved for publication and is distributed in the European Economic Area (EEA) by BofASE (France), which is authorized by the ACPR and regulated by the ACPR and the AMF; has been considered and distributed in Japan by Merrill Lynch (Japan), a registered securities dealer under the Financial Instruments and Exchange Act in Japan, or its permitted affiliates; is issued and distributed in Hong Kong by Merrill Lynch (Hong Kong) which is regulated by HKSFC; is issued and distributed in Taiwan by Merrill Lynch (Taiwan); is issued and distributed in India by DSP Merrill Lynch (India); and is issued and distributed in Singapore to institutional investors and/or accredited investors (each as defined under the Financial Advisers Regulations) by Merrill Lynch (Singapore) (Company Registration No 198602883D). Merrill Lynch (Singapore) is regulated by MAS. Bank of America N.A., Australian Branch (ARBN 064 874 531), AFS License 412901 (BANA Australia) and Merrill Lynch Equities (Australia) Limited (ABN 65 006 276 795), AFS License 235132 (MLEA) distribute this information in Australia only to 'Wholesale' clients as defined by s.761G of the Corporations Act 2001. With the exception of BANA Australia, neither MLEA nor any of its affiliates involved in preparing this information is an Authorised Deposit-Taking Institution under the Banking Act 1959 nor regulated by the Australian Prudential Regulation Authority. No approval is required for publication or distribution of this information in Brazil and its local distribution is by Merrill Lynch (Brazil) in accordance with applicable regulations. Merrill Lynch (DIFC) is authorized and regulated by the DFSA. Information prepared and issued by Merrill Lynch (DIFC) is done so in accordance with the requirements of the DFSA conduct of business rules. Bank of America Merrill Lynch International DAC, Frankfurt Branch (BAMLI DAC (Frankfurt)) distributes this information in Germany and is regulated by BaFin, the ECB and the CBI.
This information has been prepared and issued by MLPF&S and/or one or more of its non-US affiliates. The author(s) of this information may not be licensed to carry on regulated activities in your jurisdiction and, if not licensed, do not hold themselves out as being able to do so. MLPF&S is the distributor of this information in the US and accepts full responsibility for information distributed to MLPF&S clients in the US by its non-US affiliates. Any US person receiving this information and wishing to effect any transaction in any security discussed herein should do so through MLPF&S and not such foreign affiliates. Hong Kong recipients of this information should contact Merrill Lynch (Asia Pacific) Limited in respect of any matters relating to dealing in securities or provision of specific advice on securities or any other matters arising from, or in connection with, this information. Singapore recipients of this information should contact Merrill Lynch (Singapore) Pte Ltd in respect of any matters arising from, or in connection with, this information.
General Investment Related Disclosures:
Taiwan Readers: Neither the information nor any opinion expressed herein constitutes an offer or a solicitation of an offer to transact in any securities or other financial instrument. No part of

this report may be used or reproduced or quoted in any manner whatsoever in Taiwan by the press or any other person without the express written consent of BofA Merrill Lynch.

This document provides general information only, and has been prepared for, and is intended for general distribution to, BofA Merrill Lynch clients. Neither the information nor any opinion expressed constitutes an offer or an invitation to make an offer, to buy or sell any securities or other financial instrument or any derivative related to such securities or instruments (e.g., options, futures, warrants, and contracts for differences). This document is not intended to provide personal investment advice and it does not take into account the specific investment objectives, financial situation and the particular needs of, and is not directed to, any specific person(s). This document and its content do not constitute, and should not be considered to constitute, investment advice for purposes of ERISA, the US tax code, the Investment Advisers Act or otherwise. Investors should seek financial advice regarding the appropriateness of investing in financial instruments and implementing investment strategies discussed or recommended in this document and should understand that statements regarding future prospects may not be realized. Any decision to purchase or subscribe for securities in any offering must be based solely on existing public information on such security or the information in the prospectus or other offering document issued in connection with such offering, and not on this document.

Securities and other financial instruments referred to herein, or recommended, offered or sold by BofA Merrill Lynch, are not insured by the Federal Deposit Insurance Corporation and are not deposits or other obligations of any insured depository institution (including, Bank of America, N.A.). Investments in general and, derivatives, in particular, involve numerous risks, including, among others, market risk, counterparty default risk and liquidity risk. No security, financial instrument or derivative is suitable for all investors. In some cases, securities and other financial instruments may be difficult to value or sell and reliable information about the value or risks related to the security or financial instrument may be difficult to obtain. Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment. Past performance is not necessarily a guide to future performance. Levels and basis for taxation may change.

Futures and options are not appropriate for all investors. Such financial instruments may expire worthless. Before investing in futures or options, clients must receive the appropriate risk disclosure documents. Investment strategies explained in this report may not be appropriate at all times. Costs of such strategies do not include commission or margin expenses.

BofA Merrill Lynch is aware that the implementation of the ideas expressed in this report may depend upon an investor's ability to "short" securities or other financial instruments and that such action may be limited by regulations prohibiting or restricting "shortselling" in many jurisdictions. Investors are urged to seek advice regarding the applicability of such regulations prior to executing any short idea contained in this report.

This report may contain a trading idea or recommendation which highlights a specific identified near-term catalyst or event impacting a security, issuer, industry sector or the market generally that presents a transaction opportunity, but does not have any impact on the analyst's particular "Overweight" or "Underweight" rating (which is based on a three month trade horizon). Trading ideas and recommendations may differ directionally from the analyst's rating on a security or issuer because they reflect the impact of a near-term catalyst or event.

Foreign currency rates of exchange may adversely affect the value, price or income of any security or financial instrument mentioned in this report. Investors in such securities and instruments effectively assume currency risk.

UK Readers: The protections provided by the U.K. regulatory regime, including the Financial Services Scheme, do not apply in general to business coordinated by BofA Merrill Lynch entities located outside of the United Kingdom.

MLPF&S or one of its affiliates is a regular issuer of traded financial instruments linked to securities that may have been recommended in this report. MLPF&S or one of its affiliates may, at any time, hold a trading position (long or short) in the securities and financial instruments discussed in this report.

BofA Merrill Lynch, through business units other than BofA Merrill Lynch Global Research, may have issued and may in the future issue trading ideas or recommendations that are inconsistent with, and reach different conclusions from, the information presented herein. Such ideas or recommendations may reflect different time frames, assumptions, views and analytical methods of the persons who prepared them, and BofA Merrill Lynch is under no obligation to ensure that such other trading ideas or recommendations are brought to the attention of any recipient of this information.

In the event that the recipient received this information pursuant to a contract between the recipient and MLPF&S for the provision of research services for a separate fee, and in connection therewith MLPF&S may be deemed to be acting as an investment adviser, such status relates, if at all, solely to the person with whom MLPF&S has contracted directly and does not extend beyond the delivery of this report (unless otherwise agreed specifically in writing by MLPF&S). If such recipient uses the services of MLPF&S in connection with the sale or purchase of a security referred to herein, MLPF&S may act as principal for its own account or as agent for another person. MLPF&S is and continues to act solely as a broker-dealer in connection with the execution of any transactions, including transactions in any securities referred to herein.

Copyright and General Information:

Materials prepared by BofA Merrill Lynch Global Research personnel are based on public information. Facts and views presented in this material have not been reviewed by, and may not reflect information known to, professionals in other business areas of BofA Merrill Lynch, including investment banking personnel. BofA Merrill Lynch has established information barriers between BofA Merrill Lynch Global Research and certain business groups. As a result, BofA Merrill Lynch does not disclose certain client relationships with, or compensation received from, such issuers. To the extent this material discusses any legal proceeding or issues, it has not been prepared as nor is it intended to express any legal conclusion, opinion or advice. Investors should consult their own legal advisers as to issues of law relating to the subject matter of this material. BofA Merrill Lynch Global Research personnel's knowledge of legal proceedings in which any BofA Merrill Lynch entity and/or its directors, officers and employees may be plaintiffs, defendants, co-defendants or co-plaintiffs with or involving issuers mentioned in this material is based on public information. Facts and views presented in this material that relate to any such proceedings have not been reviewed by, discussed with, and may not reflect information known to, professionals in other business areas of BofA Merrill Lynch in connection with the legal proceedings or matters relevant to such proceedings.

This information has been prepared independently of any issuer of securities mentioned herein and not in connection with any proposed offering of securities or as agent of any issuer of any securities. None of MLPF&S, any of its affiliates or their research analysts has any authority whatsoever to make any representation or warranty on behalf of the issuer(s). BofA Merrill Lynch Global Research policy prohibits research personnel from disclosing a recommendation, investment rating, or investment thesis for review by an issuer prior to the publication of a research report containing such rating, recommendation or investment thesis.

Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.

The information herein (other than disclosure information relating to BofA Merrill Lynch and its affiliates) was obtained from various sources and we do not guarantee its accuracy. This information may contain links to third-party websites. BofA Merrill Lynch is not responsible for the content of any third-party website or any linked content contained in a third-party website. Content contained on such third-party websites is not part of this information and is not incorporated by reference. The inclusion of a link does not imply any endorsement by or any affiliation with BofA Merrill Lynch. Access to any third-party website is at your own risk, and you should always review the terms and privacy policies at third-party websites before submitting any personal information to them. BofA Merrill Lynch is not responsible for such terms and privacy policies and expressly disclaims any liability for them.

All opinions, projections and estimates constitute the judgment of the author as of the date of publication and are subject to change without notice. Prices also are subject to change without notice. BofA Merrill Lynch is under no obligation to update this information and BofA Merrill Lynch's ability to publish information on the subject issuer(s) in the future is subject to applicable quiet periods. You should therefore assume that BofA Merrill Lynch will not update any fact, circumstance or opinion contained herein.

Certain outstanding reports or investment opinions relating to securities, financial instruments and/or issuers may no longer be current. Always refer to the most recent research report relating to an issuer prior to making an investment decision.

In some cases, an issuer may be classified as Restricted or may be Under Review or Extended Review. In each case, investors should consider any investment opinion relating to such issuer (or its security and/or financial instruments) to be suspended or withdrawn and should not rely on the analyses and investment opinion(s) pertaining to such issuer (or its securities and/or financial instruments) nor should the analyses or opinion(s) be considered a solicitation of any kind. Sales persons and financial advisors affiliated with MLPF&S or any of its affiliates may not solicit purchases of securities or financial instruments that are Restricted or Under Review and may only solicit securities under Extended Review in accordance with firm policies.

Neither BofA Merrill Lynch nor any officer or employee of BofA Merrill Lynch accepts any liability whatsoever for any direct, indirect or consequential damages or losses arising from any use of this information.

Research Analysts

US

David Woo
FX, Rates & EM Strategist
MLPF&S
+1 646 855 5442
david.woo@baml.com

Ralph Axel
Rates Strategist
MLPF&S
+1 646 855 6226
ralph.axel@baml.com

Paul Ciana, CMT
Technical Strategist
MLPF&S
+1 646 855 6007
paul.ciana@baml.com

John Shin
FX Strategist
MLPF&S
+1 646 855 9342
joong.s.shin@baml.com

Vadim Iaralov
FX Strategist
MLPF&S
+1 646 855 8732
vadim.iaralov@baml. com

Carol Zhang
Rates Strategist
MLPF&S
+1 646 855 8311
carol.zhang@baml.com

Europe

Ralf Preusser, CFA
Rates Strategist
MLI (UK)
+44 20 7995 7331
ralf.preusser@baml.com

Ruben Segura-Cayuela
Europe Economist
Merrill Lynch (Spain)
+44 20 7995 2102
ruben.segura-cayuela@baml.com

Mark Capleton
Rates Strategist
MLI (UK)
+44 20 7995 6118
mark.capleton@baml.com

Athanasios Vamvakidis
FX Strategist
MLI (UK)
+44 20 7995 0790
athanasios.vamvakidis@baml.com

Sphia Salim
Rates Strategist
MLI (UK)
+44 20 7996 2227
sphia.salim@baml.com

Kamal Sharma
FX Strategist
MLI (UK)
+44 20 7996 4855
ksharma32@baml.com

Ruairi Hourihane
Rates Strategist
MLI (UK)
+44 20 7995 9531
ruairi.hourihane@baml.com

Sebastien Cross
Rates Strategist
MLI (UK)
+44 20 7996 7561
sebastien.cross@baml.com

Pac Rim

Tony Morriss
Rates Strategist/Economist
Merrill Lynch (Australia)
+61 2 9226 5023
tony.morriss@baml.com

Adarsh Sinha
FX Strategist
Merrill Lynch (Hong Kong)
+852 3508 7155
adarsh.sinha@baml.com

Shuichi Ohsaki
Rates Strategist
Merrill Lynch (Japan)
+81 3 6225 7747
shuichi.ohsaki@baml.com

Shusuke Yamada, CFA >>
FX/Equity Strategist
Merrill Lynch (Japan)
+81 3 6225 8515
shusuke.yamada@baml.com

Phear Sam
Rates Strategist
Merrill Lynch (Australia)
+61 2 9226 5773
phear.sam@baml.com

Trading ideas and investment strategies discussed herein may give rise to significant risk and are not suitable for all investors. Investors should have experience in FX markets and the financial resources to absorb any losses arising from applying these ideas or strategies.

>> Employed by a non-US affiliate of MLPF&S and is not registered/qualified as a research analyst under the FINRA rules.

Refer to "Other Important Disclosures" for information on certain BofA Merrill Lynch entities that take responsibility for the information herein in particular jurisdictions.

Bank of America Merrill Lynch