

US Rates Watch

US Vol – vol in delayed landing scenarios

Expectations for the dynamic of rates...

Near term, the market is likely to continue to trade around delayed landing scenarios for the US economy, which are consistent with 10y yields c.4.5%, and 3y1y OIS rates up to 3.75-4%. A medium-term balance of risks tilted to the downside in yields supports buying dips on moves towards these levels.

... and volatility

Near term (1Q and early 2Q), we expect vol levels to stay relatively anchored, with the left side likely supported vs the right, and the term structure of volatility in relatively flat to slightly positive territory. A wide range of outcomes is likely to continue to support intermediates and longer-dated expiries on the right.

Medium term (particularly beyond the first cut now expected in June), a balance of risks tilted to the downside in yields and Fed policy easing are likely to drive vols lower (outside of the knee-jerk around the shift in policy communication) and underperformance of left vs right side vol.

Trade recommendations

We favor trading the recent range in yields with a bullish bias, buying dips on moves to c.4.5% for 10yT and trading the range for the number of cuts expected over the next year tactically (selling the tails > 125-150bp & < 50-75bps).

Broadly, we continue to favor discussing recommendations in the context of a discretized range of outcomes for the outlook. Hard landing: 2s10s cap spreads and 5s30s steepeners (belly outperformance). Soft Landing: receiver spreads or ladders in the belly and short left side vs right side vol. Steady resilience / no landing: costless payer ladders in the belly and 5s30s steepeners (back-end underperformance). Reacceleration scenarios: OTM payer spreads in 1-2y tails with expiries c.3-6m.

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Abbreviations:

10yT – 10-year Treasury
ULC – Upper left corner
URC – Upper right corner
LLC – Lower left corner
LRC – Lower right corner
ITM – In the money
OTM – Out of the money
GFC – Great Financial Crisis
c. – circa (approximately)
CDF – Cumulative Distribution Function
PDF – Probability Density Function
BE – Inflation Breakevens
ERP – Equity Risk Premium
AMs – Asset Managers

For a list of open trades and trades closed in the last 12 months, please see our [Global Rates Weekly](#).

All levels as of February 23.

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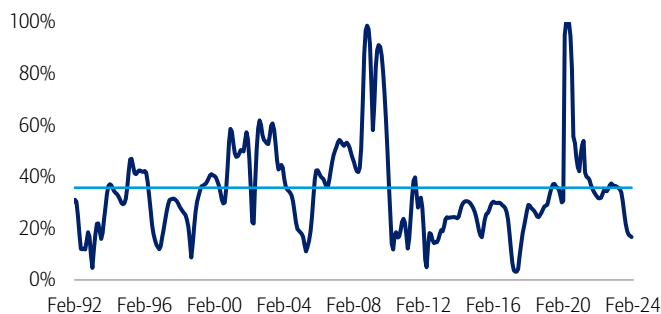
Recent dynamic of rates...

10y yields reached the highest levels since late November last week, before retracing c.10bp of the recent sell-off. The bearish dynamic has been driven by resilient data, but the market dynamic also reflects a relatively low level of conviction in the strength of recent data (see Exhibit 1).

While the recent dynamic of 10y BEs (see Exhibit 1) reflects a higher likelihood of resilience near term (normalized frequency of bear widening moves constitute c.62% of the dynamic over the last couple of months) vs. slowdown (bull tightening accounts for c.38% of the recent dynamic), these frequencies are far from the level of conviction in bullish scenarios for the economy expressed over the summer of '23 (75+%).

Exhibit 1: Level of conviction around the outlook likely still around the lower levels since late '16/17.

Low conviction likely to support market consolidation around fundamentals fair value levels

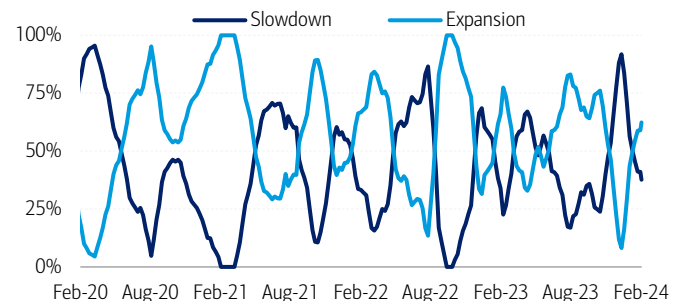


Source: BofA Global Research

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Exhibit 2: Decomposition of 10y breakeven dynamic into frequencies bear widening (expansion) and bull tightening (slowdown) moves

Normalized frequency of expansion moves have dominated the dynamic of breakevens over the last 2m



Source: BofA Global Research

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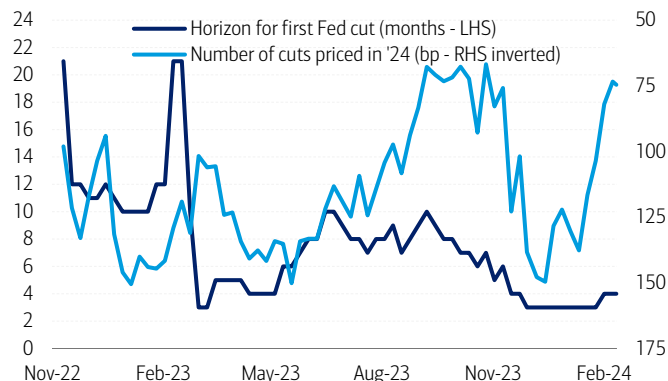
This suggests scope for scenarios where the persistence of the recent data resilience continues to drive yields higher near term. Medium term, however, the conviction in slowdown scenarios persists, and the next Fed move is still more likely to be a cut rather than a hike (see Exhibit 3). The net of these views suggests a cautious buy-the-dip stance. We recommend investors hold back on adding until 10y rate levels c.4.5%:

- Levels in this context reflect the delayed landing scenario for the US economy, in between soft landing (consistent with c.4% for 10yT and 3y1y OIS c.3-3.25%) and no-landing (c.5% for 10yT and 3y1y OIS c.4.5%). Medium-term slowdown expectations support dip-buying on sell-offs beyond the midpoint of these ranges.
- At the peak of the '23 sell-off we saw fundamental fair value for 10yT c.4.3-4.4%. 10y rates traded materially cheap to fundamentals (up to 60-70bp) on expectations for further improvement of the macro backdrop. Those expectations fizzled out over 4Q23, and yields reverted to fair values. With the threshold to reach the level of bullishness on the economy seen over the '23 sell-off relatively high (see Exhibit 2), fundamental fair values reached at the '23 peak are likely a decent gauge to define cheap yield levels in the current context.
- The ERP dynamic (defined as the spread of the internal rate of return on the S&P to 10y yields – see Exhibit 4) continues to be driven by the dynamic of yields (less scope for earnings expectations to drive the dynamic recently) and the recent levels of tightness create scope for negative feedback loops in the dynamic of rates and risk, which may cap the potential for more material sell-offs.

Bottom line: Near term, the market is likely to continue to trade around delayed landing scenarios for the US economy, which as we argue above are consistent with 10y yields c.4.5%, and 3y1y OIS rates up to 3.75-4%. A medium-term balance of risks tilted to the downside in yields supports buying dips on moves towards these levels.

Exhibit 3: Pricing of Fed policy

Cuts priced at 4m horizon, with c.3-4 cuts expected in '24

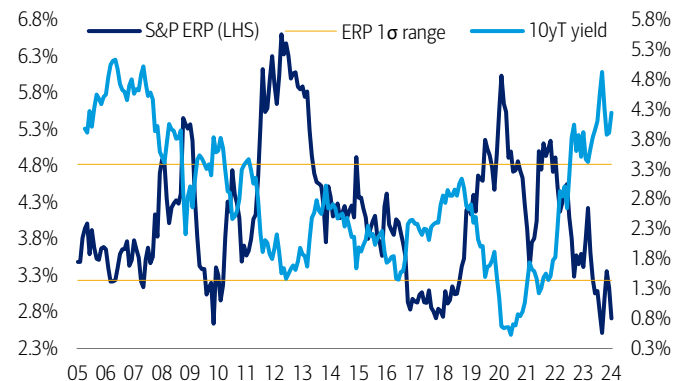


Source: BofA Global research

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Exhibit 4: Equity Risk Premium for the S&P

Tight ERP levels increase scope for negative feedback loops with yields



Source: BofA Global Research; Bloomberg

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... and volatility

The macro context above is likely to leave vol anchored near term, with the potential for some downward pressure in gamma vs intermediates. Yields are likely to continue to trade in a range near term (the likelihood of upside breakout scenarios – i.e., reacceleration – continues to be relatively low) but the range of outcomes medium term is still relatively wide (albeit with a downside balance of risks).

Not surprisingly, therefore, we have seen some underperformance of gamma vs. intermediate expiries year-to-date (Exhibit 5). The moves over the past week contributed broadly to this dynamic with vols lower led by the URC, and with only the ULC finding some support (see Exhibit 9). Volatility in the belly and right side of the grid looks fair/cheap on PCA Z-Scores (see Exhibit 16 and Exhibit 18).

Exhibit 5: YTD changes on the US volatility grid

Underperformance of gamma vs intermediate and longer date expiries

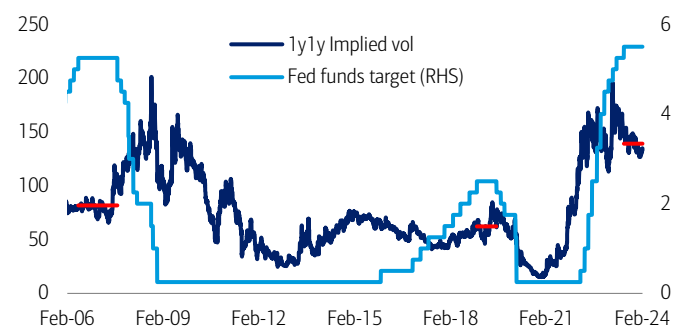
	1y	2y	3y	5y	7y	10y	30y
1m	-4	-5	-6	-6	-5	-7	-6
3m	-6	-8	-6	-6	-5	-7	-4
6m	-6	-3	-3	-3	-3	-3	1
1y	0	-1	-2	0	1	2	5
2y	4	4	3	2	2	3	6
3y	5	3	2	3	3	4	6
4y	4	3	2	3	3	4	6
5y	5	4	3	3	3	4	6
10y	4	5	5	5	5	4	5
15y	4	5	5	5	5	4	5
30y	3	4	4	4	4	3	4

Source: BofA Global Research

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Exhibit 6: Implied 1y1y vol (currently c.135bp) vs Fed funds

Left side vols (tied to uncertainty around Fed policy) high vs sub-100bp seen in recent Fed on-hold periods at the cycle peak (in '06-07 and '18-19 – red)



Source: BofA Global Research; Bloomberg

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Uncertainty around the Fed policy trajectory (less about the direction and more about timing and the magnitude) continues to support some richness of ATM vols on the left vs right side (see Exhibit 12 for the recent dynamic and Exhibit 6 for a multi-cycle view), and therefore give-ups to the forwards for conditional bull steepeners (see Exhibit 33) and bear flatteners (see Exhibit 35).

The richness in payer skew that we see on the right side of the grid (see Exhibit 29) is driven by the hedging of higher yield tails scenarios that continue to be the key pain trade (particularly for AMs as we noted in our [Postcard from London](#), 1 Feb '24). Ratios of payer over receiver volumes stand at c.1.19 over the last week (see Exhibit 59 and Exhibit 60). On the ULC, the pricing of Fed cuts (at a 3-6m horizon, even if on a rolling basis – see Exhibit 3) supports the richness of receiver over payer skew.

Bottom line: Near term (1Q and early 2Q), we expect vol levels to stay relatively anchored, with left side likely supported vs the right, and the term structure of volatility in relatively flat to slightly positive territory (see Exhibit 13). A wide range of outcomes is likely to support intermediates and longer-dated expiries on the right (Formosa issuance continues to be low and is less of a risk for the vega dynamic, even if issuance levels have increases slightly vs '23 – see Exhibit 64).

Medium term (particularly beyond the first cut now expected in June), a balance of risks tilted to the downside in yields and Fed cuts are likely to drive vols lower (outside of the knee-jerk on the shift in policy communication) and underperformance of left vs right.

Trade recommendations

We favor trading the recent range in yields with a bullish bias, buying dips to c.4.5% for 10yT and trading the range for cuts expected over the next year tactically (selling the tails > 125-150bp and < 50-75bps). Broadly, we continue to favor discussing recommendations in the context of a discretized range of outcomes for the outlook:

Hard landing

Data recouples to the downside, cuts frontloaded, curve bull steepens (first in 5s30s and closer to the first cut in 2s10s). 10yT yields reach their steady state c.3.25% (± 25 bp). Fed is priced to cut below the neutral, i.e., 3y1y fwds < c.2.75-3%. We favor **2s10s cap spreads** and **5s30s steepeners** (outperformance of belly on the curve near).

Soft landing

10yT recouples to c.4% levels as policy lags unfold. US growth levels > 0 but < potential. Policy cuts seen as “insurance”. Fed priced to cut to the neutral c.3% at horizons c.2-3y. We favor **3y1y receiver spreads** or **Costless 3y1y receiver ladders** (with downside breakeven c.1.65% for 1y SOFR, and risk a rally beyond the downside breakeven with potentially unlimited downside) and **short left vs right side vol**.

Steady resilience / no landing

US growth steady at or slightly above potential, but inflation expectations anchored. Fed stays on hold. Uncertainty continues to drive some pricing of Fed cuts at a 1y horizon, and 10yT yields trade at a slight premium to front-end yields (i.e., peak 10yT yields c.5%). We favor **costless payer ladders in the belly** 5-10y tails and extend the view for potential expiries to 6-12m (e.g., **costless 2y1y payer ladders** with downside breakeven c.5.65% for 1y SOFR, and risk a sell-off beyond the breakeven with potentially unlimited downside).

Re-acceleration

The economy either re-accelerates or stays resilient but sees recoupling of inflation to growth fundamentals. Full pricing out of Fed cuts from the curve, and potentially the pricing in of hike expectations. 10yT likely push beyond c.5.5% in this context.

It is difficult to estimate where yields peak in these scenarios. If neutral rate expectations revert to the pre-GFC regime (c.4-4.25%) and the economy stays in the post Volcker regime, where it is enough for the Fed to tighten 200bp vs. neutral to land the economy, then one can expect peak policy rates c. 6.25%. For the 10yT, the conviction that the Fed must slow down the economy drives the pricing of cuts medium term. In practical terms, this means that it is difficult for 10yT yields to trade at a discount to the front end also in this context (i.e., 10yT < c.6.25%). We favor **OTM payer spreads (e.g., atm+25bp/atm+50bp) in 1y-2y tails with expiries in the 3-6m context** (see Too many CB cuts priced?, [6 December 2023](#)).

Levels and Recent Moves

Exhibit 7: ATM Normal Volatility Grid

110bp for 1y10y volatility on Friday's close

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	108	129	126	121	113	105	86
3M	116	126	124	120	113	106	91
6M	126	129	124	118	113	108	94
1Y	136	132	127	118	114	110	97
2Y	128	124	121	115	111	107	94
3Y	122	119	116	111	107	103	91
4Y	117	114	111	106	103	99	88
5Y	112	109	107	103	99	96	85
10Y	93	92	90	86	84	81	73
30Y	68	67	66	63	62	57	54

Source: BofA Global Research

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Exhibit 8: ATM Volatility Grid – 3m Z-Scores

Gamma cheap on the belly & right side, elsewhere fair/rich

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	0.3	0.1	-0.2	-0.5	-0.7	-1.0	-1.6
3M	0.1	-0.5	-0.5	-0.5	-0.8	-1.0	-1.2
6M	-0.2	-0.2	-0.4	-0.6	-0.7	-0.8	-0.6
1Y	0.3	0.7	0.4	-0.1	0.2	0.5	0.8
2Y	0.7	0.7	0.8	0.7	0.8	0.9	1.1
3Y	1.0	1.0	1.1	1.0	1.1	1.0	1.2
4Y	1.2	1.3	1.2	1.2	1.1	1.0	1.3
5Y	1.4	1.4	1.3	1.2	1.2	1.0	1.3
10Y	1.4	1.4	1.4	1.3	1.3	1.3	1.5
30Y	1.7	1.7	1.7	1.7	1.7	1.6	1.7

Source: BofA Global Research

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Exhibit 9: ATM Normal Volatility Grid – CoW

ULC outperforming last week, elsewhere underperformance led by URC

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	4.3	4.5	1.3	-3.4	-4.4	-5.4	-8.3
3M	1.1	-0.3	-1.5	-2.7	-3.5	-4.3	-4.8
6M	1.4	0.7	-0.8	-2.3	-3.1	-3.8	-4.7
1Y	0.0	0.0	-1.0	-2.9	-3.0	-3.2	-3.9
2Y	-0.4	-0.7	-1.1	-2.0	-2.4	-2.9	-3.4
3Y	-0.7	-0.9	-1.3	-1.9	-2.3	-2.8	-3.0
4Y	-0.8	-1.0	-1.3	-1.7	-2.1	-2.6	-2.5
5Y	-1.2	-1.4	-1.5	-1.8	-2.0	-2.4	-2.4
10Y	-1.8	-1.8	-1.7	-1.7	-1.7	-1.8	-1.6
30Y	-1.0	-1.0	-1.0	-0.9	-0.9	-0.8	-0.8

Source: BofA Global Research

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Exhibit 10: ATM Straddle Premiums (indicative only)

6.9% straddle premiums for 1y10y

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	0.2%	0.6%	0.8%	1.2%	1.6%	2.0%	3.6%
3M	0.4%	0.9%	1.4%	2.1%	2.7%	3.5%	6.6%
6M	0.7%	1.3%	1.9%	2.9%	3.8%	4.9%	9.4%
1Y	1.0%	1.9%	2.7%	4.1%	5.3%	6.9%	13.4%
2Y	1.3%	2.4%	3.5%	5.4%	7.0%	9.1%	17.9%
3Y	1.4%	2.8%	4.0%	6.1%	8.0%	10.3%	20.5%
4Y	1.5%	2.9%	4.2%	6.5%	8.5%	11.1%	22.2%
5Y	1.6%	3.1%	4.4%	6.8%	8.9%	11.6%	23.3%
10Y	1.6%	3.0%	4.3%	6.7%	8.8%	11.5%	24.0%
30Y	1.0%	2.0%	2.9%	4.5%	6.0%	7.8%	19.5%

Source: BofA Global Research

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Exhibit 11: 1y10y vol dynamic since the COVID recession

100-115bp more likely in 1H24, and 85-100bp more likely in 2H24



Source: BofA Global Research; Bloomberg

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Exhibit 12: 3m10y vs. 3m2y Normal Volatility

Left side still cheap vs right side

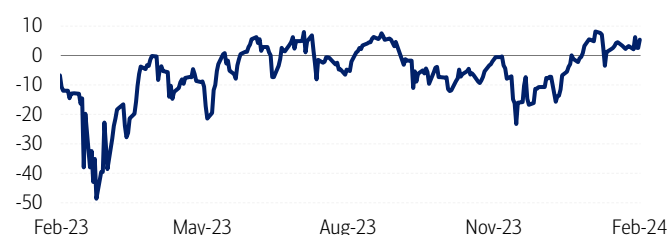


Source: BofA Global Research; Bloomberg

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Exhibit 13: 1y10y vs. 1m10y normal volatility

Vol term structure staying marginally positive

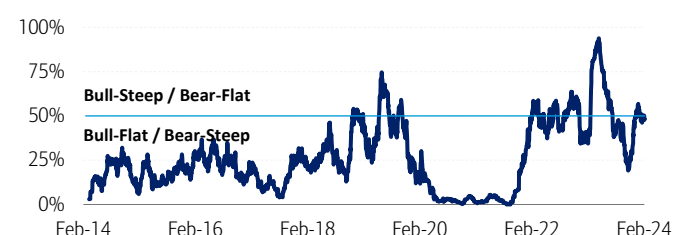


Source: BofA Global Research; Bloomberg

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Exhibit 14: 2s10s curve directionality only 50% front-end driven

Front-end degree of freedom steady over the last week



Source: BofA Global Research

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Volatility Grid Relative Value

PCA Z-SCORES

Exhibit 15: 3m Z-Scores w/ PCA framework

Left side fair/rich, right side cheap on 3m Z-Scores

	1y	2y	3y	5y	7y	10y	30y
3m	-0.4	0.8	0.7	1.2	-0.2	-1.4	-2.1
6m	-0.4	1.4	1.2	-0.1	-1.5	-1.9	-2.8
1y	0.4	1.5	0.4	-1.8	-2.3	-2.0	-2.2
2y	0.8	0.5	0.8	-0.5	-0.1	-0.9	-1.9
5y	2.0	1.3	1.1	0.5	0.3	-0.2	-1.2
10y	0.8	0.8	0.8	0.8	0.7	0.7	1.3

Source: BofA Global Research

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Exhibit 17: 6m Z-Scores w/ PCA framework

Gamma in belly and right side cheap, elsewhere fair/rich

	1y	2y	3y	5y	7y	10y	30y
3m	2.2	0.2	-0.4	-0.9	-1.8	-2.3	-2.1
6m	1.6	0.5	-0.8	-1.8	-1.8	-2.5	-1.8
1y	0.9	1.7	1.0	-1.1	-0.4	0.9	1.3
2y	1.5	1.4	1.7	0.3	1.1	1.4	1.8
5y	1.9	1.9	1.9	1.6	1.4	1.8	2.6
10y	1.7	2.5	2.5	2.4	2.4	2.0	2.9

Source: BofA Global Research

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Exhibit 19: 1y Z-Scores w/ PCA framework

Gamma in belly and right side cheap, elsewhere fair/rich

	1y	2y	3y	5y	7y	10y	30y
3m	2.0	-0.1	-0.1	-1.2	-1.7	-1.9	-1.5
6m	0.4	-0.1	-0.4	-1.7	-2.2	-2.7	-1.3
1y	0.8	1.6	0.8	-1.5	-1.1	-0.2	1.8
2y	0.8	0.6	0.8	0.4	-0.5	0.9	2.4
5y	0.7	1.0	1.0	1.3	1.7	2.0	2.5
10y	2.5	2.4	2.5	2.4	2.4	2.4	2.5

Source: BofA Global Research

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Exhibit 21: 3m Z-Scores w/ modified PCA framework ...

LLC broadly rich, elsewhere mostly fair/cheap

	1y	2y	3y	5y	7y	10y	30y
1m	0.1	-0.3	-0.5	1.2	-1.3	-1.6	-0.8
3m	-0.5	-0.7	-0.3	-0.7	-0.6	-0.9	1.2
6m	-1.0	-1.1	0.4	-0.5	-0.6	-0.3	-0.4
1y	-1.4	-2.0	2.2	-1.1	-0.4	1.0	0.2
2y	-0.5	-1.7	-1.7	-0.7	-0.9	0.3	0.5
3y	0.3	1.7	-1.0	-1.4	0.3	0.2	0.2
4y	-0.1	1.5	-1.5	-2.3	2.4	-2.5	0.5
5y	1.6	0.3	-0.3	-0.2	-1.5	-1.7	-0.7
10y	1.2	0.9	0.3	2.1	-0.4	-1.5	-0.4
15y	0.5	1.4	0.3	1.2	0.3	1.0	-1.7
30y	1.1	1.0	1.3	0.6	-0.3	0.0	1.4

Source: BofA Global Research

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Exhibit 16: 3m Z-Scores w/ PCA framework w/o rates directionality

Fair/cheap intermediates in left and belly, cheap URC

	1y	2y	3y	5y	7y	10y	30y
3m	0.8	-0.6	-1.0	-1.5	-1.9	-2.4	-2.9
6m	-0.2	-0.8	-1.2	-1.7	-2.0	-2.2	-2.3
1y	-0.8	-0.5	-0.8	-1.6	-1.5	-1.2	0.1
2y	-0.8	-1.0	-1.0	-1.1	-0.8	-0.3	1.0
5y	0.3	0.3	0.3	0.3	0.2	0.2	1.4
10y	0.7	0.9	0.9	0.9	0.9	0.9	1.4

Source: BofA Global Research

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Exhibit 18: 6m Z-Scores w/ PCA framework w/o rates directionality

Fair/cheap intermediates in left and belly, cheap URC

	1y	2y	3y	5y	7y	10y	30y
3m	1.6	0.0	-0.1	-0.5	-0.9	-1.2	-1.2
6m	0.5	-0.4	-0.5	-1.0	-1.0	-1.1	-0.9
1y	-0.5	-0.5	-0.8	-1.1	-0.9	-0.3	0.1
2y	-1.1	-1.2	-1.1	-0.9	-0.7	-0.2	0.5
5y	0.0	-0.1	-0.2	-0.2	-0.1	0.3	1.3
10y	0.8	1.1	1.1	1.1	1.2	1.5	2.1

Source: BofA Global Research

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Exhibit 20: 1y Z-Scores w/ PCA framework w/o rates directionality

Grid broadly fair/cheap when directionality is considered except for LRC

	1y	2y	3y	5y	7y	10y	30y
3m	0.0	-0.6	-0.7	-1.0	-1.2	-1.3	-1.2
6m	-0.4	-0.8	-0.9	-1.2	-1.3	-1.3	-1.1
1y	-0.7	-0.8	-0.9	-1.2	-1.0	-0.8	-0.2
2y	-0.9	-1.0	-1.0	-1.0	-0.9	-0.6	0.2
5y	-0.5	-0.5	-0.5	-0.5	-0.4	-0.1	0.9
10y	0.7	0.7	0.6	0.5	0.6	0.8	1.5

Source: BofA Global Research

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Exhibit 22: ... and w/o directionality with rates

LLC broadly rich, elsewhere mostly fair/cheap

	1y	2y	3y	5y	7y	10y	30y
1m	0.1	-0.4	-0.6	1.7	-1.0	-1.3	-0.6
3m	-0.4	-0.8	-0.6	-0.7	-0.7	-1.0	1.1
6m	-0.9	-1.2	0.4	-0.8	-0.5	-0.2	-0.5
1y	-1.4	-1.8	2.0	-1.4	-0.8	1.2	0.1
2y	-0.6	-1.7	-1.5	-0.9	-0.9	0.1	0.6
3y	0.3	1.8	-1.1	-2.0	0.0	0.3	0.3
4y	0.3	0.3	-1.2	-1.9	2.8	-2.4	0.2
5y	1.4	0.5	-0.1	-0.3	-1.6	-1.8	-0.5
10y	0.6	0.8	0.5	2.2	-0.4	-1.2	-0.6
15y	0.6	1.5	0.5	1.1	0.3	1.2	-1.7
30y	0.5	1.0	1.3	0.9	0.0	-0.1	2.1

Source: BofA Global Research

BofA GLOBAL RESEARCH

Skew Relative Value

Exhibit 23: Skew 25% delta

Receivers cheap for longer expiries on 3m Z-Scores

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	9.8	8.4	6.5	3.0	0.8	-1.2	-1.1
3M	14.8	11.6	9.5	5.0	2.2	-1.0	-1.0
6M	15.5	11.0	9.5	5.6	2.9	-0.4	-1.0
1Y	9.4	6.8	5.6	2.8	1.0	-1.7	-1.9
2Y	-2.0	-2.8	-2.6	-3.2	-3.5	-4.0	-3.7
5Y	-6.8	-6.4	-5.8	-6.0	-6.0	-6.2	-5.1
10Y	-5.7	-5.3	-4.9	-5.5	-5.9	-6.4	-4.9
30Y	-7.4	-6.8	-5.9	-6.2	-6.1	-6.5	-7.7

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 24: Skew 75% delta

Payers rich virtually across the grid on 3m Z-Scores

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	-9.1	-7.0	-4.7	-0.8	1.3	3.2	2.7
3M	-13.1	-8.7	-5.9	-0.6	2.1	4.9	4.4
6M	-9.7	-5.3	-3.4	0.8	3.4	6.3	6.1
1Y	-2.8	0.3	1.5	4.2	5.7	7.9	7.3
2Y	7.7	8.4	8.5	8.7	9.1	9.6	8.7
5Y	13.9	13.7	13.5	13.4	13.2	12.6	10.4
10Y	15.4	15.2	15.1	15.2	14.9	14.4	11.6
30Y	17.5	17.2	17.0	16.9	16.8	15.0	12.7

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 25: Breakeven Widths for Costless Receiver Ladders

107bp breakeven width for 1y10y receiver ladders

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	38	43	41	37	34	30	25
3M	77	76	73	66	60	53	46
6M	117	110	103	93	85	77	66
1Y	155	146	138	124	116	107	95
2Y	177	170	166	155	148	141	125
5Y	228	223	219	208	201	193	173
10Y	265	261	256	242	234	223	204

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 26: Breakeven Widths for Costless Payer Ladders

127bp breakeven width for 1y10y payer ladders

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	28	35	35	35	34	32	27
3M	49	57	58	60	59	59	51
6M	81	87	86	86	86	87	77
1Y	131	133	131	127	126	127	114
2Y	203	201	197	190	185	180	161
5Y	326	320	313	303	296	284	245
10Y	427	420	415	407	398	384	327

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 27: 3m Z-Score Receiver Skew (w/o fwds & ATM direction)

Receivers fair/cheap virtually across the grid, except for the ULC

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	0.8	0.6	0.3	0.0	-0.1	-0.3	-0.6
3M	1.0	0.5	0.3	-0.8	-0.5	-0.7	-1.7
6M	-1.2	-1.3	-1.1	-0.8	-0.5	-1.7	-1.2
1Y	-1.7	-1.4	-1.2	-1.0	-0.7	-1.9	-0.6
2Y	-1.4	-1.4	-1.6	-1.5	-0.8	-0.7	-0.1
5Y	-1.6	-1.9	-2.0	-2.8	-2.0	-0.9	-0.4
10Y	-1.4	-1.9	-2.1	-2.5	-1.9	-1.3	-1.0

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 28: 3m Z-Score Payer Skew (w/o direction w/ fwds & ATM)

Payer skew rich broadly across the grid

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	0.7	0.9	0.8	0.7	0.6	0.6	0.3
3M	0.4	1.0	1.3	1.7	1.6	1.5	1.5
6M	1.8	1.9	1.8	1.4	1.6	1.7	1.9
1Y	1.8	1.7	1.5	0.8	0.5	1.1	1.5
2Y	1.5	1.6	1.6	0.8	-0.6	0.2	0.2
5Y	0.6	2.1	2.1	1.9	1.5	-1.1	0.5
10Y	0.5	0.5	0.7	1.9	2.0	1.5	1.3

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 29: Ratio of Payer/Receiver BE widths for Costless Ladders

Ratios of breakeven widths < 100% for short and intermediate expiries on the left side and belly

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	73%	81%	86%	94%	100%	107%	109%
3M	64%	75%	80%	92%	100%	111%	111%
6M	69%	79%	83%	93%	102%	114%	117%
1Y	85%	91%	94%	102%	109%	119%	120%
2Y	115%	118%	119%	123%	125%	128%	129%
5Y	143%	143%	143%	146%	147%	147%	141%
10Y	161%	161%	162%	168%	170%	172%	160%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 30: 3m Z-Score Ratio of Payer/Receiver Skew

3m Z-Scores show rich payer skew over receiver skew virtually across the grid

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	0.2	2.1	2.6	3.5	3.6	3.2	3.0
3M	0.0	2.3	2.6	2.5	2.9	2.6	2.6
6M	1.8	2.5	3.5	2.6	2.2	2.2	2.0
1Y	1.9	1.9	1.9	1.9	1.7	1.5	1.5
2Y	1.3	1.9	2.0	1.9	1.6	0.3	1.1
5Y	2.0	2.6	2.8	3.0	2.3	1.4	1.6
10Y	2.3	2.1	2.5	3.2	2.9	2.4	2.4

Source: BofA Global Research

BofA GLOBAL RESEARCH

Conditional Curve Trades

Exhibit 31: Bull Flattener (pickup to forwards for ATM)

Buy longer maturity receiver, sell shorter maturity receiver

ATM	2/5s	2/10s	2/30s	5/10s	5/30s	10/30s
3M	2.6	7.1	12.0	5.0	9.9	5.4
6M	6.0	10.8	17.1	5.6	12.2	7.1
1Y	10.4	15.7	24.1	6.2	15.3	9.7
1.5Y	10.6	17.1	27.1	7.3	18.1	11.2
2Y	9.5	17.3	28.4	8.3	20.0	12.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 33: Bull Steepener (pickup to forwards for ATM)

Sell longer maturity receiver, buy shorter maturity receiver

ATM	2/5s	2/10s	2/30s	5/10s	5/30s	10/30s
3M	-2.6	-7.1	-12.0	-5.0	-9.9	-5.4
6M	-6.0	-10.8	-17.1	-5.6	-12.2	-7.1
1Y	-10.4	-15.7	-24.1	-6.2	-15.3	-9.7
1.5Y	-10.6	-17.1	-27.1	-7.3	-18.1	-11.2
2Y	-9.5	-17.3	-28.4	-8.3	-20.0	-12.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 35: Bear Flattener (pickup to forwards for ATM)

Sell longer maturity payer, buy shorter maturity payer

ATM	2/5s	2/10s	2/30s	5/10s	5/30s	10/30s
3M	-2.4	-7.7	-12.8	-5.2	-10.6	-5.8
6M	-5.8	-11.6	-18.5	-6.0	-13.2	-7.9
1Y	-10.6	-17.3	-26.5	-6.7	-16.9	-10.8
1.5Y	-11.2	-19.4	-30.6	-8.3	-20.4	-12.8
2Y	-10.6	-20.0	-32.3	-9.7	-23.1	-14.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 37: Bear Steepener (pickup to forwards for ATM)

Buy longer maturity payer, sell shorter maturity payer

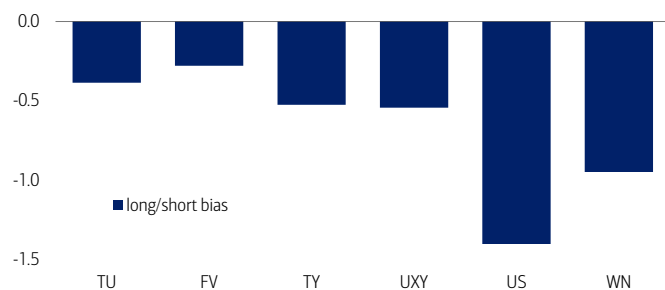
ATM	2/5s	2/10s	2/30s	5/10s	5/30s	10/30s
3M	2.4	7.7	12.8	5.2	10.6	5.8
6M	5.8	11.6	18.5	6.0	13.2	7.9
1Y	10.6	17.3	26.5	6.7	16.9	10.8
1.5Y	11.2	19.4	30.6	8.3	20.4	12.8
2Y	10.6	20.0	32.3	9.7	23.1	14.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 39: Analysis of proxies for futures positioning

Short bias, particularly at the backend



Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 32: Bull Flattener (pickup to forwards for -25bp OTM)

Buy longer maturity receiver, sell shorter maturity receiver

-25bp	2/5s	2/10s	2/30s	5/10s	5/30s	10/30s
3M	5.8	13.6	20.0	8.7	15.9	8.1
6M	9.1	16.7	24.7	8.9	17.7	9.7
1Y	13.6	20.6	30.8	8.5	19.6	12.0
1.5Y	12.8	21.2	32.7	9.5	22.0	13.4
2Y	10.8	20.2	32.7	9.9	23.3	14.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 34: Bull Steepener (pickup to forwards for -25bp OTM)

Sell longer maturity receiver, buy shorter maturity receiver

-25bp	2/5s	2/10s	2/30s	5/10s	5/30s	10/30s
3M	-5.8	-13.6	-20.0	-8.7	-15.9	-8.1
6M	-9.1	-16.7	-24.7	-8.9	-17.7	-9.7
1Y	-13.6	-20.6	-30.8	-8.5	-19.6	-12.0
1.5Y	-12.8	-21.2	-32.7	-9.5	-22.0	-13.4
2Y	-10.8	-20.2	-32.7	-9.9	-23.3	-14.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 36: Bear Flattener (pickup to forwards for +25bp OTM)

Sell longer maturity payer, buy shorter maturity payer

+25bp	2/5s	2/10s	2/30s	5/10s	5/30s	10/30s
3M	-0.9	-6.3	-14.2	-5.4	-13.4	-8.5
6M	-5.6	-11.4	-20.6	-5.8	-15.5	-10.3
1Y	-11.6	-18.5	-29.8	-6.7	-19.2	-13.2
1.5Y	-12.4	-21.2	-34.3	-8.9	-23.3	-15.3
2Y	-12.0	-22.2	-36.8	-10.8	-26.5	-16.7

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 38: Bear Steepener (pickup to forwards for +25bp OTM)

Buy longer maturity payer, sell shorter maturity payer

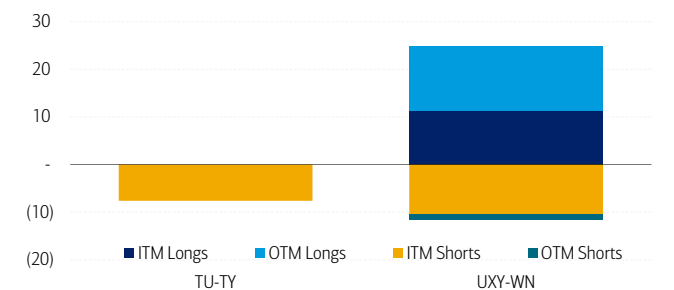
+25bp	2/5s	2/10s	2/30s	5/10s	5/30s	10/30s
3M	0.9	6.3	14.2	5.4	13.4	8.5
6M	5.6	11.4	20.6	5.8	15.5	10.3
1Y	11.6	18.5	29.8	6.7	19.2	13.2
1.5Y	12.4	21.2	34.3	8.9	23.3	15.3
2Y	12.0	22.2	36.8	10.8	26.5	16.7

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 40: Proxies for futures positioning across the curve

Backend OTM longs may drive bear steepening of the curve



Source: BofA Global Research

BofA GLOBAL RESEARCH

Forward Volatility

Exhibit 41: 6m Forward Volatility

110.1bp for 6m fwd 1y10y

	1y	2y	5y	10y	30y
1m	141.9	138.4	123.5	114.3	99.6
3m	142.3	138.0	122.6	114.3	100.0
6m	143.7	138.7	121.2	113.9	100.2
1y	136.0	132.5	118.8	110.1	97.3
2y	128.2	124.3	114.4	105.2	93.7
5y	110.7	107.9	100.6	93.5	84.3
10y	90.6	88.8	83.6	79.1	73.0

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 42: 6m Fwd vol as % ATM

100% of ATM for 6m fwd 1y10y

	1y	2y	5y	10y	30y
1m	132%	107%	102%	109%	115%
3m	123%	110%	103%	108%	109%
6m	114%	108%	103%	106%	107%
1y	100%	100%	100%	100%	101%
2y	100%	100%	99%	99%	99%
5y	99%	99%	98%	98%	99%
10y	97%	97%	97%	97%	101%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 43: 3m Z-Score 6m Fwd vol % ATM

1.7 Z-Score for 6m fwd 1y10y

	1y	2y	5y	10y	30y
1m	0.0	0.6	1.0	1.6	2.1
3m	0.3	1.6	1.2	1.7	1.9
6m	0.9	1.4	1.2	1.6	1.7
1y	1.4	1.7	1.8	1.7	1.8
2y	2.0	1.9	2.0	1.9	1.9
5y	2.3	2.3	2.5	2.4	2.5
10y	2.2	2.2	2.2	2.4	1.4

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 44: 1y Forward Volatility

105.0bp for 1y fwd 1y10y

	1y	2y	5y	10y	30y
1m	136.6	129.6	116.3	107.3	95.3
3m	134.3	128.2	117.1	107.0	94.8
6m	130.7	126.2	116.7	106.5	94.6
1y	125.9	123.7	115.5	105.0	93.7
2y	122.8	120.5	110.7	100.9	90.4
5y	107.2	104.6	97.1	90.4	82.1
10y	88.4	86.7	81.4	77.0	71.8

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 45: 1y Fwd vol as % ATM

95% of ATM for 1y fwd 1y10y

	1y	2y	5y	10y	30y
1m	127%	100%	96%	103%	110%
3m	116%	102%	98%	101%	104%
6m	103%	98%	99%	99%	101%
1y	93%	94%	98%	95%	97%
2y	96%	97%	96%	95%	96%
5y	96%	96%	95%	94%	96%
10y	95%	95%	94%	95%	99%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 46: 3m Z-Score 1y Fwd vol % ATM

1.4 Z-Score for 1y fwd 1y10y

	1y	2y	5y	10y	30y
1m	-0.1	0.4	0.9	1.5	2.2
3m	0.1	1.1	1.3	1.6	1.8
6m	0.6	1.1	1.7	1.6	1.8
1y	0.7	0.9	2.0	1.4	1.6
2y	1.8	2.0	2.0	2.0	2.0
5y	1.8	1.9	2.2	2.2	2.5
10y	1.9	2.0	1.8	1.9	2.0

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 47: 2y Forward Volatility

98.9bp for 2y fwd 1y10y

	1y	2y	5y	10y	30y
1m	119.3	118.2	112.6	102.3	91.5
3m	116.4	116.2	110.7	100.7	90.1
6m	118.8	117.0	110.0	100.2	89.5
1y	121.0	117.3	108.7	98.9	88.2
2y	115.1	112.8	104.7	95.2	85.4
5y	103.1	100.8	93.2	86.4	78.7
10y	85.6	83.8	78.4	73.9	69.8

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 48: 2y Fwd vol as % ATM

90% of ATM for 2y fwd 1y10y

	1y	2y	5y	10y	30y
1m	111%	91%	93%	98%	106%
3m	101%	92%	93%	95%	99%
6m	94%	91%	93%	93%	95%
1y	89%	89%	92%	90%	91%
2y	90%	91%	91%	89%	90%
5y	92%	92%	91%	90%	92%
10y	92%	91%	91%	91%	96%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 49: 3m Z-Score 2y Fwd vol % ATM

2.0 Z-Score for 2y fwd 1y10y

	1y	2y	5y	10y	30y
1m	0.3	0.5	1.3	1.6	2.2
3m	0.6	1.1	1.6	1.7	1.9
6m	1.2	1.3	1.8	1.9	1.9
1y	1.5	1.4	2.0	2.0	2.1
2y	1.5	1.4	2.0	2.1	2.5
5y	1.3	1.7	2.3	2.2	2.5
10y	1.9	2.0	1.5	1.1	1.9

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 50: 3y Forward Volatility

94.8bp for 3y fwd 1y10y

	1y	2y	5y	10y	30y
1m	115.9	114.0	107.0	97.7	87.0
3m	110.6	110.9	105.2	96.3	85.9
6m	111.9	111.4	104.8	95.7	85.4
1y	115.9	112.7	104.2	94.8	84.4
2y	112.8	110.1	101.3	92.3	82.2
5y	99.1	96.8	89.6	83.0	75.5
10y	83.2	81.5	76.2	71.3	68.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 51: 3y Fwd vol as % ATM

86% of ATM for 3y fwd 1y10y

	1y	2y	5y	10y	30y
1m	108%	88%	88%	93%	101%
3m	96%	88%	88%	91%	94%
6m	89%	86%	89%	89%	91%
1y	85%	85%	88%	86%	87%
2y	88%	89%	88%	87%	87%
5y	88%	88%	87%	87%	89%
10y	89%	89%	88%	88%	94%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 52: 3m Z-Score 3y Fwd vol % ATM

2.1 Z-Score for 3y fwd 1y10y

	1y	2y	5y	10y	30y
1m	0.4	0.8	1.4	1.8	2.4
3m	0.6	1.3	1.7	2.0	2.3
6m	1.1	1.3	2.0	2.1	2.5
1y	1.4	1.2	2.1	2.1	2.8
2y	1.2	1.6	1.9	2.0	2.1
5y	0.7	1.2	2.1	1.7	2.3
10y	2.0	2.1	0.6	0.0	1.4

Source: BofA Global Research

BofA GLOBAL RESEARCH

Ratios implied/delivered

Exhibit 53: Implied vs. Delivered (21d) Ratio

Ratios of Implied to 21d delivered < 100% across the grid

	1y	2y	3y	5y	7y	10y	30y
1m	100%	96%	91%	88%	87%	86%	86%
3m	89%	87%	86%	85%	85%	86%	91%
6m	83%	84%	83%	83%	84%	87%	93%
1y	83%	85%	85%	84%	86%	90%	96%
2y	85%	85%	85%	87%	88%	91%	95%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 54: Implied vs. Delivered (63d) Ratio

Ratios of Implied to 63d delivered c.100% or below across the grid

	1y	2y	3y	5y	7y	10y	30y
1m	101%	101%	100%	100%	98%	97%	92%
3m	89%	92%	94%	97%	97%	97%	97%
6m	84%	90%	92%	94%	96%	98%	99%
1y	88%	94%	97%	96%	99%	101%	102%
2y	99%	100%	100%	100%	101%	102%	101%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 55: 3m Z-Scores for Implied vs. Delivered (21d) Ratio

Ratios of implied/21d delivered fair/cheap across

	1y	2y	3y	5y	7y	10y	30y
1m	-0.2	-0.5	-0.8	-1.1	-1.2	-1.3	-1.3
3m	-0.2	-0.6	-0.8	-1.0	-1.0	-1.1	-0.9
6m	-0.4	-0.6	-0.8	-0.9	-0.9	-0.9	-0.7
1y	-0.4	-0.6	-0.7	-0.8	-0.8	-0.7	-0.5
2y	-0.8	-0.9	-0.9	-0.8	-0.8	-0.7	-0.4

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 56: 3m Z-Scores for Implied vs. Delivered (63d) Ratio

Ratios of implied/63d cheap on ULC, fair/rich elsewhere on 3m Z-Scores

	1y	2y	3y	5y	7y	10y	30y
1m	-0.7	-0.2	0.3	0.4	0.5	0.5	0.3
3m	-0.8	-0.5	0.1	1.0	1.2	1.1	1.0
6m	-0.6	0.1	0.7	1.3	1.3	1.2	1.1
1y	0.7	1.8	1.9	1.5	1.4	1.3	1.3
2y	2.0	1.9	1.8	1.5	1.4	1.3	1.3

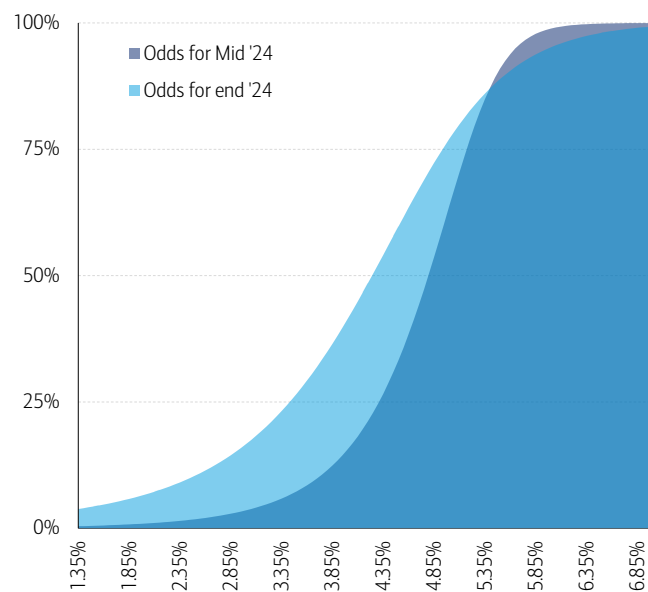
Source: BofA Global Research

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Rates probability distributions

Exhibit 57: CDF for 1y SOFR rates at mid-24 and end-24

1y rate cumulative distribution functions

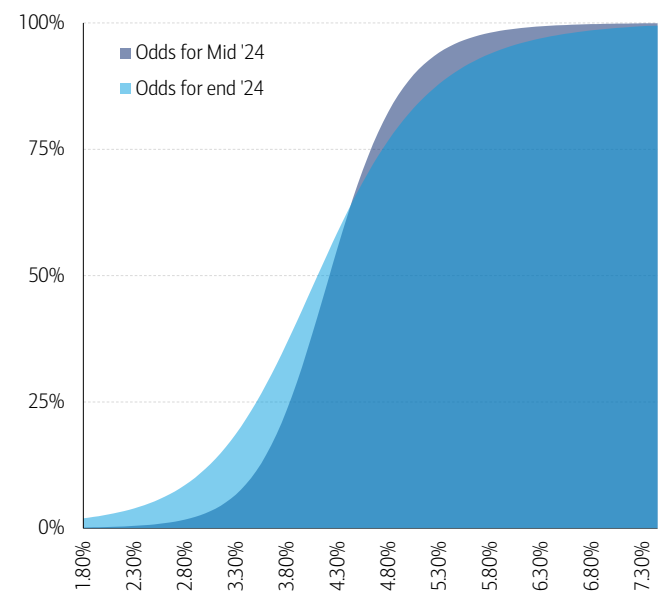


Source: BofA Global Research

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Exhibit 58: CDF for 10y SOFR rates at mid-24 and end-24

10y rate cumulative distribution functions



Source: BofA Global Research

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Trade activity

Exhibit 59: Payer volumes over the last week (\$m notional)

Demand for payers over the last week

Payers	1y	2y	3Y	4Y	5Y	7Y	10Y	20Y	30Y	
<1m	5080				440		520			6175
1m	4960	1600	240		1020	340	1761		240	11291
3m	7530	3130	671		2730	30	3454	10	1494	24217
6m	7646	690		84	440		906	795	437	12469
1y	6284	240	400	400	530	175	1414		536	9979
2y	2200					13	408	25	221	2867
3Y	250			480		241	451	68	50	1540
4Y						110	350	54		514
5Y						140	801	100	75	1116
7Y						170	100	104	175	549
10Y					50		369	313	195	927
20Y							240			240
30Y										
	33950	5660	1311	964	5210	1219	10774	1469	3423	71884

Source: BofA Global Research; SDR; Bloomberg

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Exhibit 60: Receiver volumes over the last week (\$m notional)

Demand for payers over the last week

Receivers	1y	2y	3Y	4Y	5Y	7Y	10Y	20Y	30Y	
<1m	1100			5	200		420			1745
1m	3870	100	244		770		2139		180	9103
3m	5890	1950	145		1240	200	2592	10	600	16694
6m	5026	1360	680	480	200		835	75	187	10812
1y	8713	700			2210	255	1800		1005	14683
2y	1153		960				408	25	146	2692
3Y	250			480		241	451	68	50	1540
4Y						110	180	54		344
5Y						140	751	100	75	1066
7Y						170	100	104	25	399
10Y					50		363	313	195	921
20Y							240			240
30Y										
	26002	4110	2030	965	4670	1116	10279	749	2463	60240

Source: BofA Global Research; SDR; Bloomberg

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Formosa issuance

Exhibit 61: 2023 Formosa issuance (\$m)

2.6bn total issuance for the year '23

	2	5	7	10	15	20	25	30
1	29	17						
2				370				
3		40		60				
4		205		565				
5				135		30	15	
7								
10								25
15								
20								
25								
30								1,000

Source: BofA Global Research, Bloomberg

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Exhibit 62: 2024 Formosa issuance YTD (\$m)

Very limited issuance YTD

	2	5	7	10	15	20	25	30
1		10		-	-	-	-	-
2				20	-	-	-	-
3				275	-	-	-	-
4		145		529	-	-	-	-
5				80	-	-	-	-
7				-	-	-	-	-
10				-	-	-	-	-
15				-	-	-	-	-
20				-	-	-	-	-
25				-	-	-	-	-
30				-	-	-	-	-

Source: BofA Global Research, Bloomberg

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Exhibit 63: Formosa issuance (\$m) since 2014

Peak issuance concentrated on the 5y30y tenor

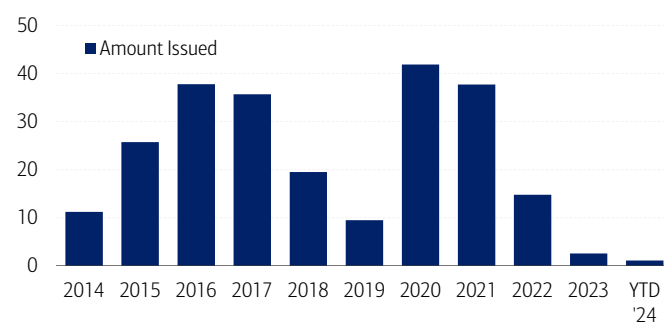
	2	5	7	10	15	20	25	30
1	29	231	75	1033	462	840		18054
2		40		1184		1485		22177
3		40		445	20	240	225	15536
4		365		1273	50	25	275	2441
5				235	445	1527	368	111658
7			30					5624
10				2000				4489
15								
20								
25								
30								6500

Source: BofA Global Research, Bloomberg

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Exhibit 64: Total issuance per year since 2014 (\$bn)

Formosa issuance YTD c.\$1.1bn



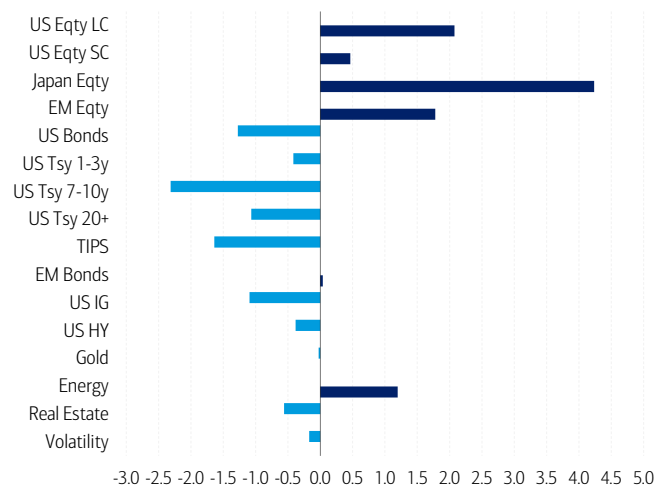
Source: BofA Global Research, Bloomberg

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Allocation bias from ETF flows

Exhibit 65: Allocation bias from ETF flows – week ending 23 Jan 24

Risk supported as UST short, equity long

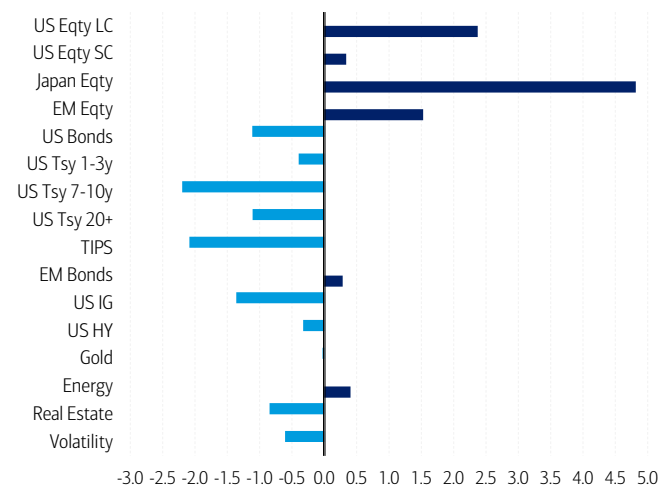


Source: BofA Global Research

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Exhibit 66: Allocation bias from ETF flows – week ending 16 Jan 24

Broad risk-on sentiment



Source: BofA Global Research

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Notes

Exhibit 14: We classify the moves on the 2s10s or 5s30s curve every day in either one of these: bear flattening & bull steepening (where the 2y or 5y leg leads) or bear steepening & bull flattening (where the 10y or 30y leg leads). We sum each one of those columns over the last two or three months and divide by the absolute value of the curve moves to get a % index for each of the four different curve dynamics. We sum up the bear flattening + bull steepening indices into a new index – when this index = 0 the entire dynamic of the 2s10s or 5s30s curve is driven by the longer leg (10y or 30y leg respectively – corresponds to periods of forward guidance for example).

Exhibit 15/17/19: We calculate the principal components of the vol grid (the Eigen vectors of the covariance matrix) and take only the first 2/3 that represent around 90% of the variance in the data. We transpose the PCA transformation to recover vols from only these 2/3 components and obtain models for the vols. We calculate the residual of these models to the original series, and the Z-Score of these residuals.

Exhibit 16/18/20: Instead of taking the first 2/3 principal components of the vol grid and apply the transpose of the PCA transformation to them, we first regress each of these vol PCs on the principal components of rates and apply the transpose of the vol PCA transformation to these models for the vol PCs. This way we remove the directionality between vol and rates from the vol dynamic, and obtain a purer Z-Score RV signal on vol.

Exhibit 25/26: In a payer/receiver ladder one buys the ATM strike and then sells ATM+/-x and ATM+/-2x. In the terminal payoff diagram, the position starts losing money when the forwards move past ATM+/-3x, which we call the downside breakeven on the payer/receiver ladder.

We calculate the x (gap between strikes) daily such that the premium one has to pay for the payer/receiver ladder is zero (any vol structure that has unlimited downside can always be structured to be costless). These breakeven widths are therefore costless downside breakeven widths. When payer/receiver skew richens, this width increases – one needs to sell higher strikes ATM+/(x+delta) and ATM+/-2(x+delta) to pay for the ATM strike bought. By looking at how these costless downside breakeven widths change over time one can measure how payer/receiver skew has richen/cheapen over time.

Exhibit 27/28: Skew is directional with forwards and with the level of vol. We regress the costless downside breakeven widths (for receivers and payers) on the forwards and ATM vol and look at the residuals of that regression to get a purer skew RV signal.



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