

European Rates Watch

EUR Vol – rates defying gravity for a little longer

ECB: Sep hike not a done deal despite hawkish forecasts

The ECB surprised last week with very hawkish forecasts, including a significant +50bp increase in headline and core inflation projections for 2023 and 2024, and a move away from target for 2025. With these forecasts one would have expected Lagarde to also signal the possibility of a September hike. We believe the limited guidance reflects large divisions on what to do after July and/or little trust in some of the drivers of the new forecasts. We keep our baseline of 3.75% terminal rate, noting that a September hike would be mostly a function core inflation prints this summer (see [Euro area Watch](#)).

...but we maintain a bearish bias for the near term

Consistent with the hawkish surprise but possible divisions within the ECB on what to do in September, the market is pricing in a 60% probability of another 25bp hike that month, conditional of 25bp being delivered in July. However, with risks around Eurozone data surprises skewed to the upside and with heavy government bond supply ahead, we remain biased bearish rates near term, looking for rates to peak in Q3.

Close receiver calendar spread; enter 6m7y payer ladder

In April, we expressed this view and a likely steepening the vol term structure by selling a 3m5y OTM receiver to finance a 1y5y receiver spread (see [ECB pricing, curve & vol, 18-Apr-23](#)). We now close the trade at 12bp (entered costless) given its delta has flipped as we near the expiry of the short option. Instead, we recommend a 6m7y payer ladder with strikes at 3.1%, 3.25% & 3.4%, receiving 7.6bp. The breakeven is at 3.55% (a level not reached since '08). 6m7y vol is still rich to delivered and richer than vol in 10y tails (Exhibit 14). 6m7y payer skew is also still rich, unlike 6m10y (Exhibit 26). We target a total P&L of 22bp, with stop at -13bp. The risk to the trade is a substantial selloff that takes us close beyond breakeven level.

We look for more inversion in 2s5s ...

The ECB's inflation forecasts also reinforce our view that the central bank will be biased to keep rates high for longer even as growth deteriorates. From a curve perspective, this supports a transition into bull-flattening as we rally, rather than a direct shift to bull-steepening (which we would expect when cuts are close to being delivered). Given the recent bear flattening in 2s10s, it is 2s5s that we see greater potential of this unfolding.

... and enter a 1y fwd 2s5s bull flattener

We recommend entering a conditional bull flattener in 1y fwd 2s5s (long €41.5mln ATM+5.8bp 1y5y receiver fully funded by the sale of €100mln ATM 1y2y receiver). As the curve dynamics continue to be led by the front-end (Exhibit 10), the vol market is providing positive pick-ups vs the forwards for bull flattener trades (Exhibit 29). With flatteners being also positive carry, the conditional versions offer high pick-up vs spot. In this 1y fwd 2s5s version, the strike differential is 28bp flatter than spot. We target a P&L of €400K, stop at -€200K. The risk is a bull steepening on rapid pricing of ECB cuts

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ULC – Upper left corner

URC – Upper right corner

LLC – Lower left corner

LRC – Lower right corner

ATM – At the money

ITM – In the money

OTM – Out of the money

CB - Central Bank

OIS – Overnight Index Swap

PC – principal component

For a list of our open trades as well as those closed over the past 12 months, please see our [Global Rates Weekly](#).

Levels for indication purposes only as of Friday's June 16th close

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Bearish rates bias near term (next 2-3 months)

For the next few months, we maintain a bearish bias especially at the front-end, with bear flattening pressures, and a cheapening of German bonds vs swaps due to:

- **Data.** Our economists showed hard economic data have been resilient even as soft data, such as manufacturing PMIs, signalled serious contraction ([Europe Economics Weekly, 9-Jun-23](#)). This means risks on economic activity are skewed to the upside.
- **Inflation and ECB reaction function.** Near-term, we think inflation will be sticky, with core prints still above 5% by the July meeting. Inflation is also expected to be above the ECB's inflation target at least through 2024. This may challenge the market's pricing of a 25bp rate cut by the ECB by April 2024.
- **Supply.** We forecast core supply to be elevated in 3Q 2023: net German supply will exceed €50bn, equivalent to a third of Germany's annual net supply ([Global Rates Weekly 26-May-23](#)). This may be a challenge for the market to absorb as positioning is already long ([FX & Rates Sentiment Survey, 9-Jun-23](#)), while growth in the euro area and US remains firm, and central banks including the Fed continue hiking.

Exhibit 1: BofA EUR rates forecast profile

We expect yields to peak sometime in 3Q23, and rally to then be driven by 5s

	3Q23	4Q23	1Q24	2Q24	YE 24	YE 25
3m Euribor	3.80	3.90	3.80	3.60	3.20	2.20
2y BKO	2.90	2.65	2.45	2.30	1.90	1.40
5y OBL	2.45	2.15	2.05	2.00	1.75	1.50
10y DBR	2.40	2.25	2.15	2.10	1.90	1.60
30y DBR	2.40	2.40	2.40	2.40	2.25	2.00
2y Euribor swap	3.60	3.35	3.10	2.90	2.40	1.80
5y Euribor swap	3.10	2.80	2.65	2.50	2.15	1.80
10y Euribor swap	3.00	2.80	2.65	2.55	2.30	1.90

Source: BofA Global Research

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Exhibit 2: Changes in BofA EUR rates forecasts

We raise our near-term forecasts and lower our long(er) term forecasts

	3Q23	4Q23	1Q24	2Q24	YE 24	YE 25
3m Euribor	0	0	0	n/a	0	n/a
2y BKO	10	5	0	n/a	0	n/a
5y OBL	15	5	0	n/a	-25	n/a
10y DBR	10	5	-5	n/a	-30	n/a
30y DBR	0	0	0	n/a	-25	n/a
2y swap	10	5	0	n/a	0	n/a
5y swap	15	5	0	n/a	-25	n/a
10y swap	10	5	-5	n/a	-30	n/a

Source: BofA Global Research

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Bull flattening to bull steepening in medium term (4Q23 to 4Q24)

We expect rates to rally after the terminal rate is reached. The pricing of cuts and slow grind lower in the market's view of neutral can put bull flattening pressures on the curve. It is only as we approach the delivery of the rate cut, the dynamics of the curve is expected to evolve to bull steepening, first in 2s10s and then in 2s5s. Our economists expect the first cut to be delivered only in Jun-24 and this, in part, explains why our forecast imply less steepening than what the market is pricing in 1y ahead.

We also expect 5y5y Euribor swaps to rally but by a lesser extent, reflecting the inflation in that period still expected to be above target and growing term premia in the curve against the backdrop of ongoing quantitative tightening (QT). The availability of bond supply, supported by QT, also leaves us with a bias for further asset swap tightening.

For the periphery, the very high demand from retail investors (see report: [Liquid Insight, 24 May 2023](#)) vs limited net government bond supply (relative to core) can help justify the benign market reaction to the growth deceleration & tightening of monetary conditions. Expectations of a soft landing have also helped the periphery, like other risk assets. As inflation drops faster than policy rates in 2024, the narrative around a hard landing or a policy mistake may gather steam, weighing on risk sentiment, potentially pushing periphery spreads wider. Support from retail demand will also hinge on the outright yields.

Long term (2025): back to pre-COVID?

Our economists forecast inflation to fall to 1.5% in 2025, clearly below the ECB's target. In our view, this may prompt the 5y5y Euribor swap rate to fall towards 2%. In this environment, the market may also reassess the neutral rate for the euro area from the 2% that the ECB has been guiding us towards, and to a lower level of between 1.25% and 1.75%. This may provide scope for further declines in rates, and is reflected in our 2y, 5y, and 10y swap forecasts for end-2025 being c. 100bp below the forwards.

Levels and Recent Moves

Despite elevated intra-day volatility, the range in 10y rates is getting narrower, supporting the decline in implied vols.

Gamma across key tenors is down to its lowest level since Mar-22, with the top left underperforming recently (Exhibit 5) although still rich to the right-hand side (Exhibit 8). This richness in left hand side is consistent with recent curve dynamics (with the front-end leading the moves – Exhibit 10).

The term structure of vol has steepened (Exhibit 9), and it is now only in 6m+ expiries that vol still trades rich to delivered (see Exhibit 13).

Exhibit 3: ATM Normal Volatility Grid

92.6bp for 1y10y volatility

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	54.1	92.5	93.0	91.1	86.8	79.3	71.5
3M	66.6	96.0	98.1	93.7	89.8	84.0	76.1
6M	84.1	100.7	99.5	97.0	93.3	87.7	78.5
1Y	104.0	108.1	105.1	100.7	97.5	92.6	82.4
2Y	107.4	107.4	105.1	101.1	98.7	94.5	82.8
3Y	103.8	103.8	102.0	98.2	96.3	92.8	80.6
4Y	100.8	100.7	98.4	95.1	93.4	90.2	77.6
5Y	98.1	97.9	96.0	92.2	90.3	87.2	74.9
10Y	85.0	84.8	82.9	79.2	77.0	73.4	62.2
30Y	65.6	65.5	63.3	58.9	55.8	51.8	41.4

Source: BofA Global Research

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Exhibit 4: ATM Volatility Grid - 3m Z-Scores

Grid cheap on 3m Z-Scores

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	-1.4	-1.3	-1.3	-1.4	-1.6	-1.8	-1.7
3M	-1.5	-1.4	-1.4	-1.5	-1.6	-1.8	-1.6
6M	-1.7	-1.7	-1.7	-1.7	-1.9	-2.1	-1.9
1Y	-1.9	-1.9	-2.0	-2.2	-2.3	-2.6	-2.5
2Y	-2.0	-2.1	-2.3	-2.5	-2.7	-2.8	-2.8
3Y	-2.0	-2.1	-2.3	-2.6	-2.8	-2.9	-2.7
4Y	-2.0	-2.1	-2.4	-2.8	-2.9	-2.9	-2.6
5Y	-1.9	-1.9	-2.2	-2.8	-2.9	-2.7	-2.5
10Y	-2.2	-2.3	-2.4	-2.7	-2.7	-2.4	-2.0
30Y	-1.6	-1.6	-1.7	-1.8	-1.8	-1.6	-1.6

Source: R BofA Global Research

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Exhibit 5: ATM Normal Volatility Grid - CoW

Underperformance of gamma (short expiries) over the last week

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	-6.7	-6.6	-6.7	-6.7	-7.1	-7.6	-7.8
3M	-7.5	-9.4	-8.7	-6.5	-6.6	-6.6	-6.7
6M	-8.9	-7.9	-6.9	-4.8	-4.8	-4.7	-5.1
1Y	-6.2	-5.5	-5.3	-4.9	-4.7	-4.5	-4.7
2Y	-2.5	-3.4	-3.5	-3.6	-3.6	-3.6	-4.4
3Y	-2.1	-2.4	-2.5	-2.6	-2.7	-2.8	-3.4
4Y	-2.2	-2.5	-2.4	-2.4	-2.3	-2.1	-2.4
5Y	-1.4	-1.4	-1.6	-2.1	-1.9	-1.7	-2.2
10Y	-1.5	-1.5	-1.5	-1.3	-1.3	-1.3	-1.1
30Y	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.3

Source: BofA Global Research

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Exhibit 6: ATM Straddle Premiums (indicative only)

6.2% straddle premiums for 1y10y

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	0.1%	0.4%	0.6%	1.0%	1.2%	1.6%	3.4%
3M	0.3%	0.7%	1.1%	1.7%	2.2%	2.9%	6.3%
6M	0.5%	1.1%	1.6%	2.5%	3.3%	4.2%	9.1%
1Y	0.8%	1.6%	2.3%	3.6%	4.7%	6.1%	13.2%
2Y	1.1%	2.2%	3.1%	4.9%	6.5%	8.5%	18.3%
3Y	1.3%	2.5%	3.6%	5.7%	7.6%	10.0%	21.4%
4Y	1.4%	2.7%	3.9%	6.2%	8.3%	10.9%	23.3%
5Y	1.5%	2.9%	4.2%	6.5%	8.7%	11.5%	24.6%
10Y	1.6%	3.1%	4.5%	6.9%	9.2%	12.1%	26.1%
30Y	1.3%	2.7%	3.8%	5.8%	7.6%	9.9%	20.8%

Source: BofA Global Research

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Exhibit 7: 1y10y volatility

Current level 92.6bp

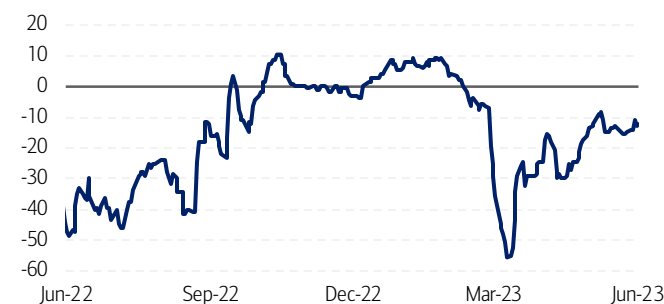


Source: BofA Global Research; Bloomberg

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Exhibit 8: 3m10y vs. 3m2y Normal Volatility

Left side continues to trade rich to the right side



Source: BofA Global Research; Bloomberg

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Exhibit 9: 1y10y vs. 1m10y Normal Volatility

Vol term structure steepened in recent weeks

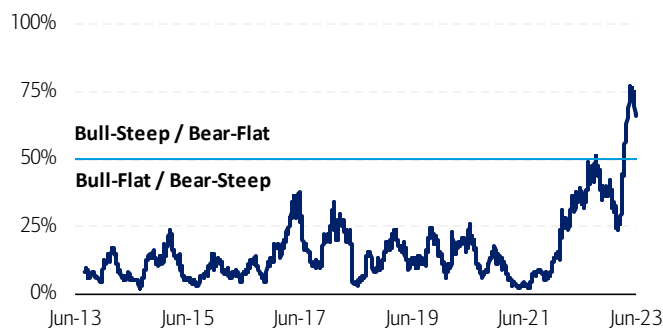


Source: BofA Global Research; Bloomberg

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Exhibit 10: 2s5s curve directionality

Frontend driving 66% of the 2s5s curve directionality over last 3m



Source: BofA Global Research

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Ratios implied/delivered

Exhibit 11: Implied vs. Delivered (21d) Ratio

Ratios of Implied to 21d delivered <100% on the left side

	1y	2y	3y	5y	7y	10y	30y
1m	91%	102%	98%	100%	104%	103%	103%
3m	91%	98%	100%	101%	107%	108%	109%
6m	88%	93%	97%	103%	109%	111%	112%
1y	86%	94%	100%	108%	116%	118%	117%
2y	100%	111%	112%	122%	127%	129%	118%

Source: BofA Global Research

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Exhibit 12: Implied vs. Delivered (63d) Ratio

Ratios of Implied to 63d delivered still <100% except for LRC

	1y	2y	3y	5y	7y	10y	30y
1m	69%	90%	89%	94%	97%	95%	96%
3m	67%	85%	88%	94%	98%	99%	101%
6m	73%	83%	88%	96%	102%	103%	104%
1y	80%	88%	95%	102%	108%	109%	110%
2y	93%	104%	106%	114%	117%	117%	112%

Source: BofA Global Research

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Exhibit 13: 3m Z-Scores for Implied vs. Delivered (21d) Ratio

Ratios of implied/21d delivered fair/cheap in gamma and left side, fair/rich in LRC

	1y	2y	3y	5y	7y	10y	30y
1m	-0.7	-0.5	-0.7	-0.6	-0.5	-0.5	0.0
3m	0.0	-0.1	-0.2	-0.1	0.0	0.1	0.3
6m	0.0	0.0	0.0	0.1	0.2	0.3	0.4
1y	0.0	0.0	0.1	0.2	0.4	0.5	0.5
2y	0.3	0.4	0.4	0.6	0.8	0.9	0.6

Source: BofA Global Research

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Exhibit 14: 3m Z-Scores for Implied vs. Delivered (63d) Ratio

Ratios of implied/63d delivered rich for intermediate expiries, particularly on the right side

	1y	2y	3y	5y	7y	10y	30y
1m	-0.5	-0.2	-0.5	-0.2	-0.1	-0.4	0.7
3m	0.4	0.3	0.0	0.8	1.2	1.3	1.8
6m	1.2	0.5	0.5	1.7	2.0	1.8	2.4
1y	1.5	1.0	1.6	1.8	1.8	1.7	2.4
2y	1.5	1.6	1.5	1.7	1.6	1.7	2.3

Source: BofA Global Research

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Volatility Grid Relative Value

PCA Z-SCORES

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

Richness for short and intermediate expiries in the belly/left side, cheapness on the right side

	1y	2y	3y	5y	7y	10y	30y
3m	-2.1	1.0	1.5	1.2	0.4	-1.0	0.7
6m	-1.3	0.7	1.5	2.0	0.1	-1.5	-0.7
1y	1.2	1.3	1.2	-0.1	-1.2	-2.7	-1.5
2y	1.9	1.5	-0.8	-1.2	-2.4	-3.5	-2.2
5y	1.3	1.1	0.1	-1.7	-1.6	-2.1	-2.3
10y	-0.5	-0.7	-1.0	-1.6	-2.3	-1.7	-1.1

Source: BofA Global Research

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

Short and intermediate expiries in the belly slightly rich

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

Source: BofA Global Research

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

Richness for intermediate expiries in the belly/left side, cheapness in the URC of the grid

	1y	2y	3y	5y	7y	10y	30y
3m	-2.6	0.1	-0.2	-0.6	-1.1	-1.6	-1.1
6m	-0.5	1.5	1.7	0.2	-1.0	-1.8	-1.3
1y	-1.5	1.9	1.7	1.1	0.6	-1.0	-0.9
2y	2.0	1.8	1.5	1.3	0.9	-0.4	-0.6
5y	1.6	1.5	1.4	0.9	0.9	0.6	0.5
10y	0.4	0.3	0.3	0.2	0.0	-0.5	0.3

Source: BofA Global Research

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

Cheapness across the grid when directionality with rates is considered

	1y	2y	3y	5y	7y	10y	30y
3m	-2.9	-3.1	-3.2	-3.3	-3.6	-4.0	-3.4
6m	-3.0	-3.0	-3.1	-3.1	-3.4	-3.8	-3.6
1y	-2.7	-2.7	-2.8	-3.0	-3.3	-3.8	-3.5
2y	-2.0	-2.1	-2.4	-2.9	-3.3	-4.0	-3.5
5y	-1.7	-1.7	-2.1	-3.0	-3.2	-3.9	-3.3
10y	-2.3	-2.4	-2.7	-3.2	-3.6	-3.6	-2.4

Source: BofA Global Research

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

Cheapness across the grid when directionality with rates is considered

	1y	2y	3y	5y	7y	10y	30y
3m	-1.5	-1.1	-1.2	-1.7	-2.0	-2.7	-2.7
6m	-1.3	-1.1	-1.2	-1.6	-1.9	-2.7	-2.7
1y	-0.7	-0.8	-1.0	-1.4	-1.7	-2.3	-2.4
2y	-0.6	-0.7	-0.9	-1.2	-1.4	-1.9	-2.0
5y	-0.8	-0.8	-0.9	-1.2	-1.3	-1.3	-1.3
10y	-1.2	-1.3	-1.4	-1.4	-1.5	-1.6	-0.9

Source: BofA Global Research

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

Cheapness across the grid when directionality with rates is considered

	1y	2y	3y	5y	7y	10y	30y
3m	-1.4	-0.8	-1.0	-1.3	-1.5	-1.8	-1.7
6m	-1.0	-0.7	-0.9	-1.2	-1.4	-1.6	-1.5
1y	-0.3	-0.3	-0.6	-0.9	-1.1	-1.3	-1.3
2y	-0.1	-0.3	-0.5	-0.8	-0.9	-1.1	-1.2
5y	-0.5	-0.6	-0.6	-0.8	-0.8	-0.9	-0.9
10y	-0.9	-0.9	-0.9	-1.0	-1.0	-1.1	-0.9

Source: BofA Global Research

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Skew Relative Value

Exhibit 21: Skew 25% delta

Rich receiver skew on the ULC

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	1.5	2.1	1.7	1.1	0.8	0.4	0.7
3M	3.4	4.1	3.7	2.5	2.0	1.2	1.8
6M	5.1	5.2	4.4	3.1	2.4	1.5	2.3
1Y	7.4	6.4	5.4	3.5	2.8	1.8	2.9
2Y	4.3	3.5	2.9	2.0	1.7	1.3	2.4
3Y	2.4	1.7	1.4	0.9	0.8	0.7	1.9
4Y	0.8	0.4	0.3	0.1	0.2	0.3	1.7
5Y	-0.5	-0.7	-0.7	-0.5	-0.3	0.0	1.5
10Y	-2.5	-2.4	-2.1	-1.6	-0.5	1.0	2.2
15Y	-2.0	-2.1	-1.6	-0.8	0.2	1.6	2.2
30Y	-3.6	-3.6	-2.7	-1.1	0.3	2.1	1.5

Source: BofA Global Research

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Exhibit 22: Skew 75% delta

Payer skew above receiver virtually elsewhere

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	-0.9	-1.1	-0.8	-0.1	0.2	0.5	0.0
3M	-1.5	-1.3	-0.7	0.5	0.9	1.5	0.6
6M	-1.2	-0.6	0.0	1.2	1.8	2.5	1.3
1Y	0.3	0.9	1.5	2.4	3.0	3.8	2.4
2Y	4.8	4.7	4.8	5.0	5.1	5.3	3.6
3Y	5.8	5.7	5.7	5.6	5.7	5.7	4.0
4Y	6.5	6.3	6.2	6.0	6.0	5.9	4.2
5Y	7.0	6.8	6.6	6.3	6.2	6.0	4.3
10Y	7.7	7.7	7.3	6.5	5.7	4.4	3.3
15Y	7.0	7.1	6.5	5.4	4.9	3.9	3.4
30Y	6.1	6.0	5.1	3.2	2.9	2.5	2.8

Source: BofA Global Research

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Exhibit 23: Breakeven Widths for Costless Receiver Ladders

97bp breakeven width for 1y10y receiver ladders

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	17	28	28	28	26	24	21
3M	38	54	54	51	48	44	41
6M	69	81	79	75	72	66	61
1Y	121	122	117	109	104	97	89
2Y	166	163	158	150	146	139	125
5Y	220	219	215	207	203	197	176
10Y	259	258	254	245	244	241	212

Source: BofA Global Research

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Exhibit 24: Breakeven Widths for Costless Payer Ladders

101bp breakeven width for 1y10y payer ladders

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	15	27	27	27	26	24	21
3M	33	48	50	49	47	45	40
6M	60	73	73	73	71	68	59
1Y	106	111	109	107	105	101	88
2Y	167	167	164	159	156	151	129
5Y	256	254	249	239	234	226	190
10Y	326	325	316	299	285	263	220

Source: BofA Global Research

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Exhibit 25: 3m Z-Score Receiver Skew (w/o fwds & ATM direction)

Receiver skew fair/cheap broadly across the grid

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	-1.1	-0.7	-0.8	-0.5	-0.4	-0.7	-0.4
3M	-1.4	-0.9	-0.7	-0.6	-0.8	-1.8	-0.2
6M	-1.6	-1.7	-1.6	-1.8	-2.1	-1.2	-0.8
1Y	-0.2	-0.7	-0.8	-0.5	-0.7	-1.3	0.4
2Y	0.2	0.1	-0.2	-0.7	-1.1	-1.5	-0.1
5Y	0.7	0.8	0.6	-0.1	-0.5	-1.1	0.1
10Y	0.7	0.7	0.7	1.0	0.9	1.0	1.8

Source: BofA Global Research

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Exhibit 26: 3m Z-Score Payer Skew (w/o direction w/ fwds & ATM)

Payer skew fair/rich broadly across the grid

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	0.1	0.1	0.0	-0.3	-0.5	-0.4	0.1
3M	0.8	0.6	0.3	0.0	-0.2	-0.7	0.2
6M	1.0	1.0	0.8	0.6	0.5	0.1	0.5
1Y	0.9	0.6	0.7	1.2	1.4	1.3	0.3
2Y	-0.8	-0.6	-0.3	0.3	0.6	0.8	-1.1
5Y	-0.8	-0.9	-0.7	0.0	0.3	0.8	-0.3
10Y	-0.4	-0.5	-0.4	0.0	0.3	0.9	2.0

Source: BofA Global Research

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Exhibit 27: Ratio of Payer/Receiver BE widths for Costless Ladders

Ratios of breakeven widths < 100% across gamma

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	92%	94%	96%	97%	98%	100%	99%
3M	87%	91%	92%	96%	98%	101%	97%
6M	87%	90%	92%	97%	99%	102%	98%
1Y	88%	91%	93%	98%	101%	104%	99%
2Y	101%	102%	103%	106%	107%	109%	103%
5Y	116%	116%	116%	115%	115%	114%	108%
10Y	126%	126%	125%	122%	117%	109%	104%

Source: BofA Global Research

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Exhibit 28: 3m Z-Score Ratio of Payer/Receiver Skew

Z-Scores cheap payer vs receiver skew virtually across the grid

	1Y	2Y	3Y	5Y	7Y	10Y	30Y
1M	-0.8	-0.7	-0.6	-1.3	-0.9	-0.8	0.2
3M	-0.9	-0.7	-0.9	-0.8	-0.9	-0.8	-1.2
6M	-0.7	-0.8	-0.7	-0.7	-0.6	-0.5	-0.5
1Y	-0.7	-0.7	-0.7	-0.8	-0.9	-0.8	-1.1
2Y	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.9
5Y	-1.0	-1.0	-1.1	-1.2	-1.0	-0.2	-0.6
10Y	-1.1	-1.1	-1.1	-0.7	-0.9	-1.1	0.2

Source: BofA Global Research

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Conditional Curve Trades

Exhibit 29: 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	0.9	4.6	7.9	3.8	7.1	3.3
6M	2.1	7.1	12.2	5.2	10.2	5.5
1Y	5.8	11.6	19.0	6.1	14.1	8.2
1.5Y	7.1	13.8	23.3	7.1	17.0	10.4
2Y	6.9	13.6	25.4	7.1	19.4	12.7

Source: BofA Global Research

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Exhibit 31: 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	-0.9	-4.6	-7.9	-3.8	-7.1	-3.3
6M	-2.1	-7.1	-12.2	-5.2	-10.2	-5.5
1Y	-5.8	-11.6	-19.0	-6.1	-14.1	-8.2
1.5Y	-7.1	-13.8	-23.3	-7.1	-17.0	-10.4
2Y	-6.9	-13.6	-25.4	-7.1	-19.4	-12.7

Source: BofA Global Research

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Exhibit 33: 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	-0.8	-4.6	-7.0	-3.8	-6.2	-2.7
6M	-2.0	-7.1	-11.3	-5.2	-9.6	-4.7
1Y	-5.7	-11.8	-18.1	-6.4	-13.3	-7.4
1.5Y	-7.1	-14.2	-22.6	-7.3	-16.4	-9.7
2Y	-7.1	-14.2	-25.2	-7.5	-18.9	-12.3

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 35: 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	0.8	4.6	7.0	3.8	6.2	2.7
6M	2.0	7.1	11.3	5.2	9.6	4.7
1Y	5.7	11.8	18.1	6.4	13.3	7.4
1.5Y	7.1	14.2	22.6	7.3	16.4	9.7
2Y	7.1	14.2	25.2	7.5	18.9	12.3

Source: BofA Global Research

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Exhibit 30: 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	2.1	8.1	12.6	6.3	10.8	4.9
6M	3.6	10.7	17.0	7.5	14.1	7.1
1Y	7.9	15.5	24.2	8.3	17.6	9.8
1.5Y	9.1	17.3	28.3	8.9	20.5	12.1
2Y	8.3	16.3	29.7	8.5	22.5	14.7

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 32: 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	-2.1	-8.1	-12.6	-6.3	-10.8	-4.9
6M	-3.6	-10.7	-17.0	-7.5	-14.1	-7.1
1Y	-7.9	-15.5	-24.2	-8.3	-17.6	-9.8
1.5Y	-9.1	-17.3	-28.3	-8.9	-20.5	-12.1
2Y	-8.3	-16.3	-29.7	-8.5	-22.5	-14.7

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 34: 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	-0.5	-5.7	-10.1	-5.2	-9.5	-4.9
6M	-12.5	-8.3	-14.6	-6.4	-12.9	-7.2
1Y	-6.3	-13.4	-22.0	-7.3	-16.6	-10.1
1.5Y	-8.1	-16.1	-26.9	-8.3	-19.9	-12.5
2Y	-7.9	-16.1	-29.5	-8.5	-22.8	-15.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 36: 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	0.5	5.7	10.1	5.2	9.5	4.9
6M	12.5	8.3	14.6	6.4	12.9	7.2
1Y	6.3	13.4	22.0	7.3	16.6	10.1
1.5Y	8.1	16.1	26.9	8.3	19.9	12.5
2Y	7.9	16.1	29.5	8.5	22.8	15.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Forward Volatility

Exhibit 37: 6m Forward Volatility

94.6bp for 6m fwd 1y10y

	1y	2y	5y	10y	30y
1m	100.5	106.2	99.5	93.5	83.0
3m	104.4	109.0	100.4	94.2	83.1
6m	105.7	108.9	102.3	95.8	84.7
1y	100.6	108.4	101.7	94.9	83.2
2y	107.4	106.2	100.2	94.0	80.9
5y	96.8	96.4	90.4	84.4	72.1
10y	82.2	82.0	76.5	70.9	59.8

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 38: 6m Fwd vol as % ATM

102% of ATM for 6m fwd 1y10y

	1y	2y	5y	10y	30y
1m	186%	115%	109%	118%	116%
3m	157%	114%	107%	112%	109%
6m	126%	108%	105%	109%	108%
1y	97%	100%	101%	102%	101%
2y	100%	99%	99%	99%	98%
5y	99%	98%	98%	97%	96%
10y	97%	97%	97%	97%	96%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 39: 3m Z-Score 6m Fwd vol % ATM

1.7 Z-Score for 6m fwd 1y10y

	1y	2y	5y	10y	30y
1m	1.5	1.0	0.9	1.3	1.0
3m	1.9	1.4	1.0	1.4	0.9
6m	1.8	1.5	1.2	1.6	1.1
1y	1.4	1.6	1.3	1.7	1.3
2y	1.5	1.5	1.8	1.8	1.7
5y	1.0	2.3	2.6	2.2	2.2
10y	0.4	2.6	2.1	1.8	2.0

Source: BofA Global Research

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Exhibit 40: 1y Forward Volatility

95.6bp for 1y fwd 1y10y

	1y	2y	5y	10y	30y
1m	105.9	107.8	101.1	93.7	81.0
3m	106.9	110.1	102.5	94.9	82.0
6m	109.3	111.9	102.6	94.7	81.7
1y	102.8	108.5	102.1	95.6	81.9
2y	103.5	103.2	97.9	92.3	78.5
5y	94.1	94.0	88.4	81.8	69.3
10y	80.4	80.3	74.8	69.1	57.5

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 41: 1y Fwd vol as % ATM

103% of ATM for 1y fwd 1y10y

	1y	2y	5y	10y	30y
1m	196%	117%	111%	118%	113%
3m	161%	115%	109%	113%	108%
6m	130%	111%	106%	108%	104%
1y	99%	100%	101%	103%	99%
2y	96%	96%	97%	98%	95%
5y	96%	96%	96%	94%	92%
10y	95%	95%	94%	94%	92%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 42: 3m Z-Score 1y Fwd vol % ATM

1.8 Z-Score for 1y fwd 1y10y

	1y	2y	5y	10y	30y
1m	1.9	1.5	1.3	1.7	1.2
3m	2.1	1.9	1.5	1.8	1.3
6m	2.3	2.0	1.5	1.9	1.4
1y	1.8	1.6	1.7	1.8	1.3
2y	1.7	1.6	1.7	1.5	1.5
5y	0.5	1.1	2.1	1.6	1.8
10y	1.8	0.7	1.5	1.2	1.5

Source: BofA Global Research

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Exhibit 43: 2y Forward Volatility

88.4bp for 2y fwd 1y10y

	1y	2y	5y	10y	30y
1m	112.6	104.8	92.9	87.9	72.5
3m	108.6	101.7	92.9	88.6	73.8
6m	112.1	102.4	93.8	89.1	73.9
1y	84.1	90.9	90.9	88.4	74.4
2y	90.0	96.2	90.1	86.4	71.4
5y	88.0	88.0	82.6	76.7	63.2
10y	78.1	78.3	72.7	66.3	53.6

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 44: 2y Fwd vol as % ATM

95% of ATM for 2y fwd 1y10y

	1y	2y	5y	10y	30y
1m	208%	113%	102%	111%	101%
3m	163%	106%	99%	106%	97%
6m	133%	102%	97%	102%	94%
1y	81%	84%	90%	95%	90%
2y	84%	90%	89%	91%	86%
5y	90%	90%	90%	88%	84%
10y	92%	92%	92%	90%	86%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 45: 3m Z-Score 2y Fwd vol % ATM

1.7 Z-Score for 2y fwd 1y10y

	1y	2y	5y	10y	30y
1m	2.1	1.7	1.7	1.9	1.4
3m	2.1	1.9	1.8	1.9	1.7
6m	2.3	2.2	1.9	2.0	1.9
1y	1.9	1.9	1.9	1.7	1.7
2y	0.5	1.1	1.2	1.7	1.8
5y	1.2	0.7	2.2	1.6	1.9
10y	1.4	0.5	1.2	1.1	1.6

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 46: 3y Forward Volatility

83.9bp for 3y fwd 1y10y

	1y	2y	5y	10y	30y
1m	101.7	91.4	87.9	82.9	65.7
3m	91.7	91.2	88.2	83.8	67.1
6m	92.7	96.2	89.2	84.3	67.4
1y	77.2	93.5	86.8	83.9	68.1
2y	93.9	94.9	85.1	81.3	66.4
5y	82.8	82.8	77.5	72.5	58.3
10y	76.7	77.0	71.1	64.0	50.2

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 47: 3y Fwd vol as % ATM

91% of ATM for 3y fwd 1y10y

	1y	2y	5y	10y	30y
1m	188%	99%	97%	104%	92%
3m	138%	95%	94%	100%	88%
6m	110%	96%	92%	96%	86%
1y	74%	86%	86%	91%	83%
2y	87%	88%	84%	86%	80%
5y	84%	85%	84%	83%	78%
10y	90%	91%	90%	87%	81%

Source: BofA Global Research

BofA GLOBAL RESEARCH

Exhibit 48: 3m Z-Score 3y Fwd vol % ATM

2.3 Z-Score for 3y fwd 1y10y

	1y	2y	5y	10y	30y
1m	2.2	1.9	1.9	2.3	1.9
3m	3.2	2.6	1.8	2.2	2.2
6m	2.8	2.4	1.8	2.3	2.3
1y	1.4	1.9	1.7	2.3	2.1
2y	2.6	2.0	1.7	2.3	2.1
5y	0.8	0.6	1.7	1.3	1.9
10y	1.3	1.3	1.1	1.1	1.6

Source: BofA Global Research

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Notes

Exhibit 10: 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 2 or 3 months and divide by the absolute value of the curve moves to get a % index for each of the 4 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 PCs 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 23/24: In a payer/receiver ladder one buys the ATM strike and then you sell ATM+/-x and ATM+/-2x. 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 must 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 25/26: 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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