US Rates Watch

Monthly rates models update

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Rates Research
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Monthly rates models update

We update some of the rates models we use to gauge risk bias, positioning, and relative value across duration, curve, real yields, breakevens and frontend spreads.

Duration & curve: Rates continue to trade rich vs fundamentals (c.20-40bp), reflecting expectations for a deteriorating macro backdrop over the next 3-6m. Curve dynamic continues to be driven by the frontend, but bias has shifted from predominantly bull steepening to bear flattening over the last two weeks.

TIPS: 10y breakevens trade in line with fundamentals, with BE dynamic more orthodox (driven primarily by bear-widening and bull-tightening moves). 10y real yields c.30bp rich in our macro framework.

Front end: SOFR/FF framework suggests that in the current environment of high ON RRP take-up SOFR will likely remain low relative to FF which is likely to rise under the Fed's QT regime.

Asset allocation: A mean variance analysis of recent returns and covariances across asset classes shows a downgrade of optimal allocations from profiles consistent with a risk-on market dynamic in 4Q22 into profiles consistent with a transition market dynamic in 1Q23. A gauge of risk profile and allocations obtained from ETF flows shows some upgrade of risk over the last couple of weeks.

10yT – 10y Treasury
DM – Developed Markets
EM – Emerging Markets
SOFR – Secured Overnight Financing Rate
IORB – Interest rate On Reserve Balances
EFFR – Effective Federal Funds Rate
FF – Fed funds
ON RRP – Overnight Reverse Repo facility
BE – Breakeven
LC – Large Cap
SC – Small Cap
QT – Quantitative Tightening
ETF – Exchange Traded Funds
PCA – Principal Component Analysis
VAR – Vector Auto-Regressive
RV – Relative Value

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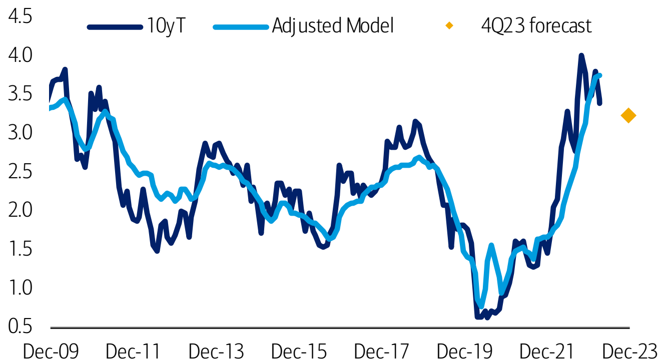
Refer to important disclosures on page 11 to 12. 12542450

Timestamp: 11 April 2023 06:45AM EDT

Duration

Macro model

Exhibit 1: 10yT macro fair value
10yT fair value consistent with current fundamentals c.3.75%



Source: BofA Global Research

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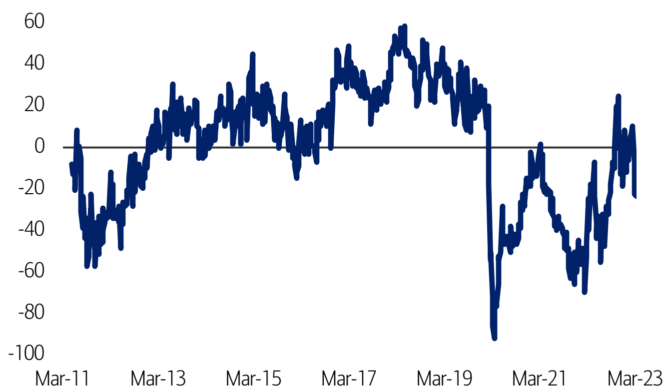
Our macro framework suggests 10yT yield is in line with current fundamentals c.3.75%

Treasury yields trading rich to fair value suggest expectations for deteriorating fundamentals over the next 3-6m

Global yield framework

Exhibit 2: Residual of 10yT Global yield model
10yT fair value consistent with current global yields c.3.65%



Source: BofA Global Research

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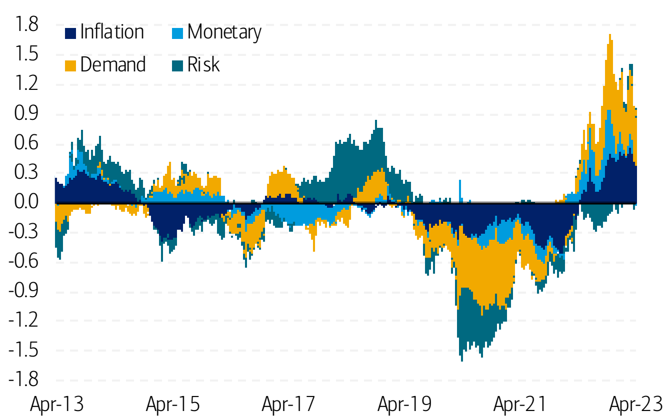
10yT trading c.20-25bp rich relative to global yields.

Scenarios where the recent risk off sentiment fades near-term imply c.20-25bp bearish potential for 10yT towards fair levels vs. global yields

A more significant selloff from there would likely need to be supported by a broader bearish momentum in the DM sovereign complex

Decomposition of the 10yT dynamic

Exhibit 3: Decomposition of the 10yT dynamic
... as a function of monetary policy, demand, risk, and inflation shocks



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Steady state upgraded from c.2% in early '22 to 2.4% currently, suggesting an upgrade for neutral rate expectations. We expect it to increase further towards c.2.75%

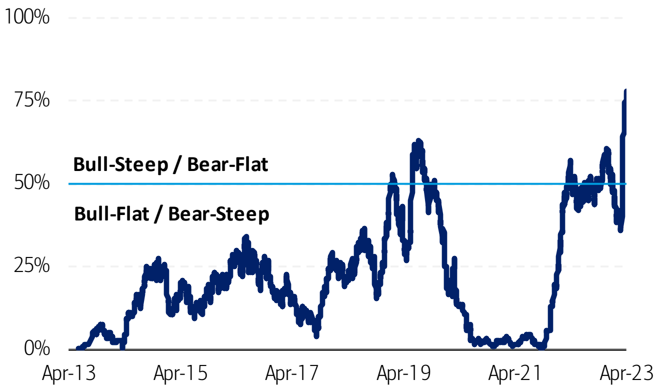
10yT yield range likely shifted higher from 0.75-3.25% (125bp envelope around a 2% steady state) over the last cycle to a range c.1.25-4.24% over the next 1-3y (125-150bp envelope around a 2.75% steady state)

Monetary policy and risk shocks currently flat, demand and inflation continue to drive some cheapening vs c.2.25-2.5% steady state

Curve

Curve directionality

Exhibit 4: 2s10s directionality Index
Dynamic shifted from bull steepening to bear flattening over last 2w



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Frontend drives 100% of the 2s10s curve dynamic over the last month, 90% of the dynamic over the last 3 months

Curve directionality continues to be driven by a bull steepening dynamic

Exhibit 5: Decomposition of the 2s10s dynamic
Frontend continues to lead the dynamic

	bull-Steep	bear-Flat	bull-Flat	bear-Steep
2w	31%	69%	0%	0%
1m	58%	42%	0%	0%
2m	46%	39%	7%	9%
3m	40%	38%	10%	12%

Source: BofA Global Research

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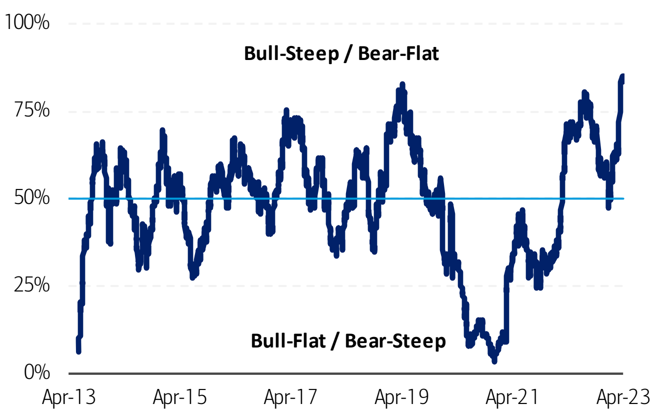
Exhibit 6: 5s30s directionality Index
Bull steepening still dominating the dynamic over the last 2w



Source: BofA Global Research

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Belly drives 79% of the 5s30s curve dynamic over the last two weeks, 94% of the dynamic over the last month

Curve directionality continues to be driven by a bull steepening dynamic, but to a less extent vs the last month

Exhibit 7: Decomposition of the 5s30s dynamic
Belly continues to lead the dynamic

	bull-Steep	bear-Flat	bull-Flat	bear-Steep
2w	43%	36%	21%	0%
1m	61%	33%	6%	0%
2m	51%	36%	9%	4%
3m	46%	39%	9%	6%

Source: BofA Global Research

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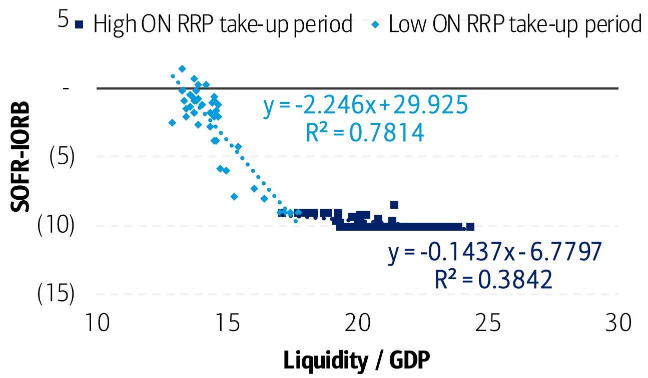
Front end

SOFR/FF basis

Exhibit 8: SOFR-IORB spread vs Liquidity / GDP
When ON RRP take-up is high, SOFR is anchored to ON RRP



Source: BofA Global Research, Bloomberg, Federal Reserve

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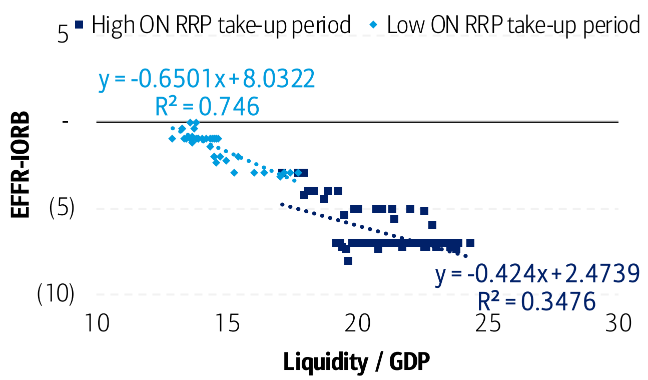
We forecast SOFR-IORB spread via a linear regression of ON RRP + Fed Reserves (Fed liquidity) over GDP & Marketable debt to GDP.

We break out the regression into two periods, a high and low ON RRP take-up period with the high take-up referring to anything above $500bn in ON RRP take-up.

We find that when ON RRP take-up is high, SOFR is anchored to ON RRP, 10bps below SOFR

Exhibit 9: EFFR-IORB spread vs Liquidity / GDP
EFFR is less sticky vs SOFR but curve is less steep in low ON RRP period



Source: BofA Global Research, Bloomberg, Federal Reserve

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We break out the regression into two periods, a high and low ON RRP take-up period with the high take-up referring to anything above $500bn in ON RRP take-up.

We find that EFFR is less sticky than SOFR, but the curve is less steep relative to SOFR-IORB in the low ON RRP take-up period

Exhibit 10: Regression outputs for FF-SOFR spread (bps)
In high ON RRP take-up period, FF-SOFR spread widens as FF lifts faster

	Low ON RRP take-up			High ON RRP take-up		
Date	SOFR-IORB	EFFR-IORB	FF-SOFR	SOFR-IORB	EFFR-IORB	FF-SOFR
Dec-2022	-16	-5	11	-10	-6	4
Mar-2023	-18	-6	12	-10	-6	4
Jun-2023	-11	-4	7	-9	-5	4
Sep-2023	-9	-3	6	-9	-5	4
Dec-2023	-3	-1	2	-9	-3	6
Mar-2024	1	-1	-2	-8	-3	5
Jun-2024	1	0	-1	-8	-3	5
Sep-2024	2	0	-2	-8	-3	5
Dec-2024	2	0	-2	-8	-2	6

Source: BofA Global Research, Bloomberg, Federal Reserve

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Using the regression inputs for both periods we forecast FF-SOFR spread based on our forecast for ON RRP, Reserves, Marketable debt ex Fed and GDP

In the high ON RRP take-up regression output, FF-SOFR spread widens as EFFR lifts off faster than SOFR

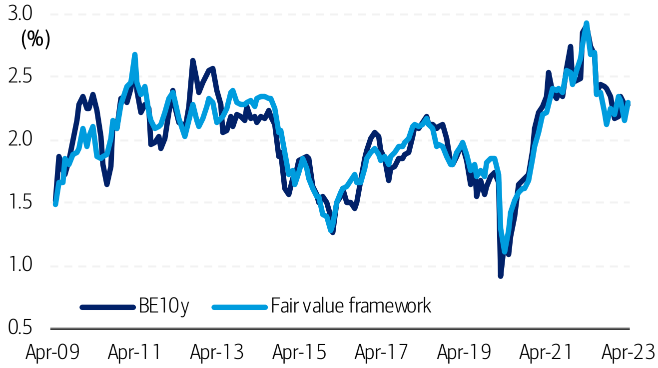
In the low ON RRP take-up regression output, FF-SOFR spread narrows as SOFR lifts off faster than EFFR

We use the High ON RRP take-up regression for the entirety of our forecast window given expectations for ON RRP take-up to remain elevated over the period

TIPS

Macro framework for breakevens (BEs)

Exhibit 11: Macro framework for 10y BE
10y BE fair value c.225bp, market trading c.5bp wide



Source: BofA Global Research

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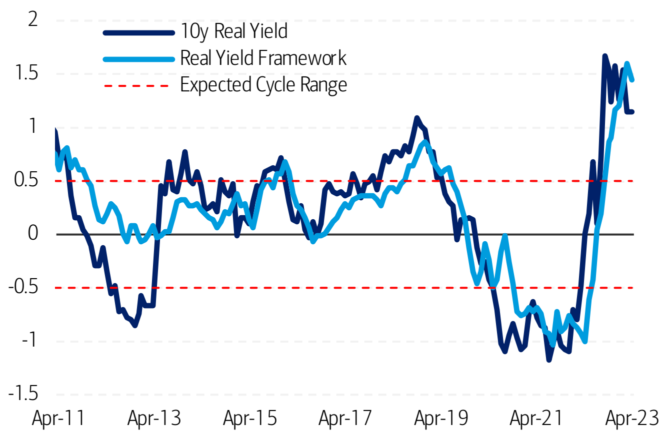
Model 10y BE as a function of inflation expectation, inflation risk premium, and inflation liquidity premium components

US 10y breakevens currently trading c.5bp above/rich vs fair value c.225bp

Real yield (10y BE vs 10y nominal model)

Exhibit 12: 10y real yield framework
Fair value for 10y real yields in macro framework c.145bp



Source: BofA Global Research

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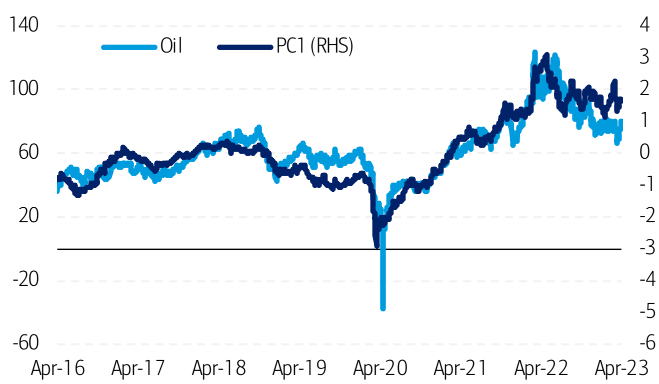
US 10y real rate currently below the fair value suggested by our macro framework c.145bp

PCA on global 10y BEs

Exhibit 13: First breakeven closely matches 1st crude oil futures
Oil is a primary driver of global inflation expectations



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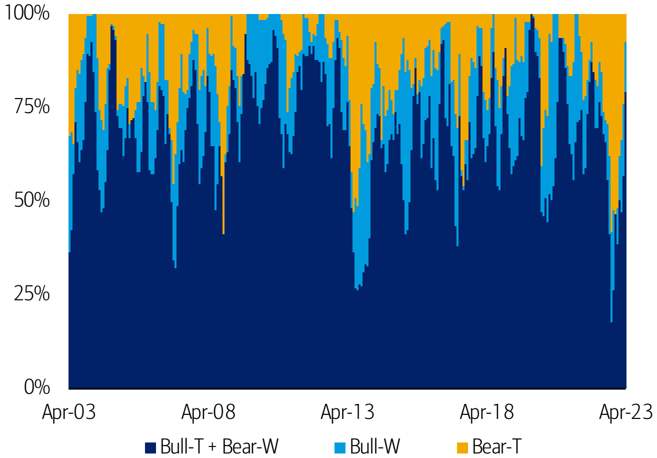
1st principal component of global 10y BEs suggests that oil has become the main driver of global inflation expectations for several years now.

This also implies that any single central bank may have very limited impact on its domestic inflation expectation markets

Directionality of 10y BEs

Exhibit 14: Breakeven directionality breakdown
10y breakevens showing a more standard directionality now



Source: BofA Global Research

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10y breakevens showing a more standard directionality now

Orthodox moves (bull tightening and bear widening) back to dominating the dynamic and in line with historical frequencies

Bear-tightening which dominated the dynamic in late–'22 and early '23 (potentially reflecting poor liquidity) now reduced to 7%.

Exhibit 15: 10y Breakeven directionality
Bull tightening and bear widening driving the 10yBE dynamic again

	bull-Tight	bear-Wide	bull-Wide	bear-Tight
Current	41%	39%	13%	7%
1m	26%	34%	13%	28%
2m	26%	29%	14%	32%
3m	26%	35%	12%	26%

Source: BofA Global Research

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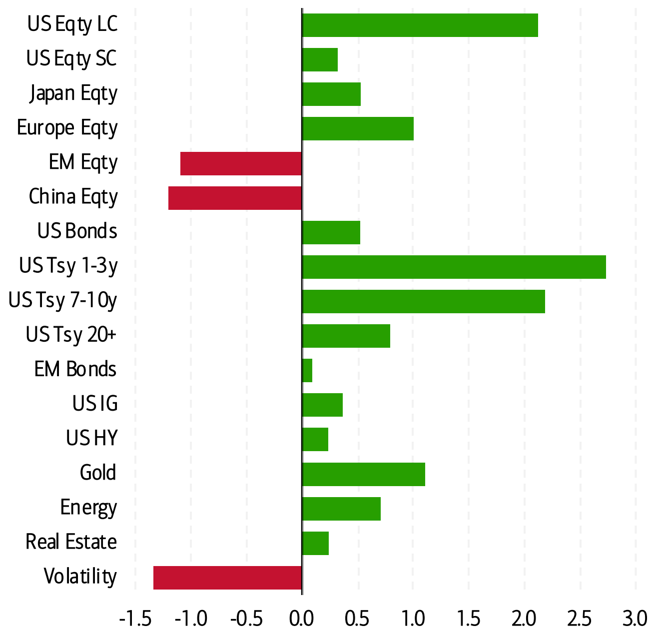
Asset allocation

Flows and allocation bias

Exhibit 16: Gauge of risk profile obtained from ETF flows
Recent upgrade to risk appetite



Source: BofA Global Research

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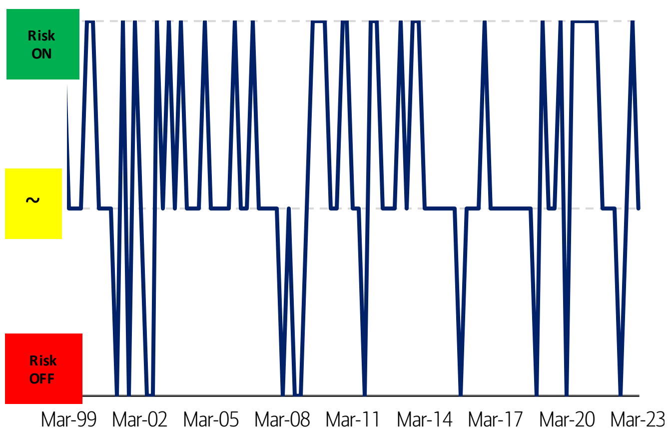
Gauge of risk profile and allocations obtained from ETF flows shows upgrade of risk over the last couple of weeks:

- Bonds – Long bonds, particularly frontend and belly
- Equities – Long DM / short EM
- Credit – Small Long IG & HY
- Alternatives – Long gold & Energy
- Volatility – Short rates volatility

Exhibit 17: Regimes for quarterly performance across asset classes
Market dynamic in 4Q22 was closer to risk on.... shift towards a transition dynamic in 1Q23



Source: BofA Global Research

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Downgrade of optimal allocations from profiles consistent with a risk-on market dynamic in 4Q22 into profiles consistent with a transition market dynamic in 1Q23.

Market dynamic over 2Q likely to push optimal asset allocations profiles between those implied by risk-off/recession and transition states. Demand for duration is likely to stay robust over 2Q in our baseline view.

Exhibit 18: Transition probabilities between different states for the market dynamic
Transition probability from risk-off/recession to risk-on (57%) is much larger than the transition probability from risk-on to risk-off

	Risk off	~	Risk on
Risk off	14%	29%	57%
~	16%	61%	23%
Risk on	6%	61%	32%

Source: BofA Global Research

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Appendix: Model descriptions

Macro model

In our macro framework for the dynamic of Treasuries we calculate the first two PCs of the rates curve (2s, 5s, 10s and 30s), and regress each of these on fed funds (to define cycle dynamic) and the principal components of: growth variables, inflation variables, and employment variables (see A hitchhikers guide to RV on the UST curve).

Macro models are calibrated over long historical windows, generally longer than the average cycle length (somewhere between 7-15 years) to capture the broader dynamic of Treasuries throughout the cycle. Significantly, these models tend to break down in periods of significant non-economic buying of Treasuries. We have seen several of these periods over the last couple of cycles, for example:

- The Greenspan conundrum, where we saw the backend of the Treasury curve rallying even as the Fed hiked rates in the early stages of the '04-'06 tightening cycle, driven foreign central bank buying
- QE periods, where Fed acts as a non-economic buyer. Indeed, in general these periods drive a negative correlation between growth and yields, and it is a challenge to avoid solutions that converge to these sorts of non-economic betas in macro frameworks for the dynamic of yields
- Global yield demand in a context of very low global yields. Indeed, global demand for USTs may be driven less by US fundamentals but more by yield differentials to other DM yields and the cost of hedging the FX exposure

To account for the pressures on the Treasury curve from these non-economic distortions we include in our independent data set the dynamic of the Fed balance sheet and the first principal component of global DM rates. In our framework, therefore, we converge to two solutions, one where we express fair value consistent with US macro fundamentals alone, and an adjusted framework where we incorporate the impact of overseas demand on the Treasury curve.

Global yield framework

This framework is an alternative approach to PCA that addresses the shortcoming of PCA not being able to capture trends in the data to a large extent. The framework can achieve this by capturing the shared covariances in the dataset through hidden state processes and also allows for the modeling of the time-varying dynamic of these factors explicitly. In a relatively simple specification, a number of factors (determined a-priori) are defined through a given state equation:

$$x(t) = B * x(t - 1) + w(t)$$

while the independent variables are modeled as a function of these factors:

$$y(t) = Z * x(t) + v(t)$$

where:

$$w(t) \sim MVN(0, Q)\ ,\ \ v(t) \sim MVN(0, R)\ ,\ x(0) \sim MVN(X0, V0)$$

The factors (*x's*) are calibrated to explain the dynamic of the independent variables (*y's*) through the linear combinations defined by the calibrated projection matrix (*Z*). The projection matrix Z can be constrained to add more intuition to the interpretability of the factors.

Decomposition of the 10yT dynamic

In statistics, the traditional frequentist approach assumes that each parameter has a "true" value, and the goal is to find a close estimate to that (fixed) value. In contrast, the Bayesian approach views each parameter as a random variable, characterized by some underlying probabilistic distribution, along with constrains on the relative dynamic of the different parameters. The latter allows the analyst to avoid non-economic solutions, for example models where Treasury yields are negatively correlated with growth.

The vector auto-regressive framework is used to capture the relationship between multiple time series as they evolve over time, versus lagged levels. A *p*th-order VAR refers to a VAR model with a time lag for the last *p* time periods and is denoted VAR(*p*). This can be expressed as:

$$y(t) = a0 + A1 * y(t-1) + \ldots + Ap * y(t-p) + \varepsilon(t) \text{ with } \varepsilon(t) \sim N(0,\Sigma)$$

Where $y(t)$ is the $M \times 1$ vector of endogenous variables, $a0$ is the $M \times 1$ vector of constants, Ai is the $M \times M$ time-variant coefficient matrix, and $\varepsilon(t)$ is the $M \times 1$ exogenous factor or the error terms with a Gaussian distribution with mean zero and variance-covariance matrix Σ.

In our formulation we adapt an existing ECB framework[1] to decompose the dynamic of 10yT yields in terms of monetary policy, demand, risk, and inflation shocks. The key in this model is to define the sign restriction priors that transform the dynamic of the underlying variables in the model (10yT yields, 5y5y inflation, real effective exchange rate for the dollar, and cyclical adjusted P/E ratios) into the shocks below (see A hitchhikers guide to RV on the UST curve).

Curve directionality

One framework that adds to the understanding of the dynamic of the curve is a measure of how frequent the different modes for the curve (bull flattening, bear steepening, bear-flattening and bull steepening) have been in recent history. One can do this by constructing 4 indices, one for each mode, that measures the number of bp moves that can be attributed to that mode in a given historical window vs the sum of absolute moves on the curve over the same period. Those 4 indices can be grouped into short leg (2yT leg in the 2s10s dynamic) driven moves (adding the bear-flattening and bull steepening indices) and belly (10yT in the 2s10s dynamic) driven moves (adding bull flattening and bear steepening moves). This framework is useful to gauge the prevailing modes on the curve and understand the periods where the curve is undergoing a shift in its dynamic.

PCA on global 10y BEs

We run a 2-factor PCA on 10y breakevens across US, UK, AU, JP, EU and CAD with at least 6 years of history. While central bank policy is certainly a factor for the global inflation market - especially around pivots or other surprises - we find that the first principal component (PC1) explains 85% of the variance in global breaks and is highly correlated with the price of oil. The second principal component of breakevens accounts for 9% of the variance - which results in a total of 94% covered by 2 factors. We found PC2 correlates well to global financial stress and the Fed's published real rate term premium (see Rates relative value update with PCA).

[1] *European Central Bank, Financial Stability Review, Nov. 2018,* www.ecb.europa.eu/pub/pdf/fsr/ecb.fsr201811.en.pdf

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