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The US 2s10s Curve And The Risk Of Recession

- **The flattening of the US yield curve has come to the forefront of attention among both market participants and Federal Reserve officials.**
- **The 2s10s Treasury curve is around 50bps and market pricing implies it will be 25bps in a year's time. The swap and OIS curves are even flatter. There are pros and cons when it comes to what curve one looks at.**
- **Historically, an inverted US yield curve has been an excellent predictor of US recession, with one of its advantages that it has provided a far earlier signal than other financial market variables. The lag between 2s10s inversion and recession post-1977 has spanned between 12 months to almost 2 years.**
- **We estimate two simple probit models of US recessionary risk, based on the 2s10s Treasury curve and the S&P500. The risk of recession this year appears close to zero, and looks low for next year too. But assuming the yield curve continues to flatten in line with the forwards, the estimated probability of recession moves higher over time according to these models. An inversion of the curve and a fall in equities would lift the estimated probability of recession meaningfully.**
- **There are reasons to be sceptical that the curve is giving a 'pure' read of recessionary risk at present given the impact QE has had in depressing term premia. That said, there were various explanations offered in the past to look through yield curve inversion, and recession almost always followed. The historic record of the yield curve is formidable.**

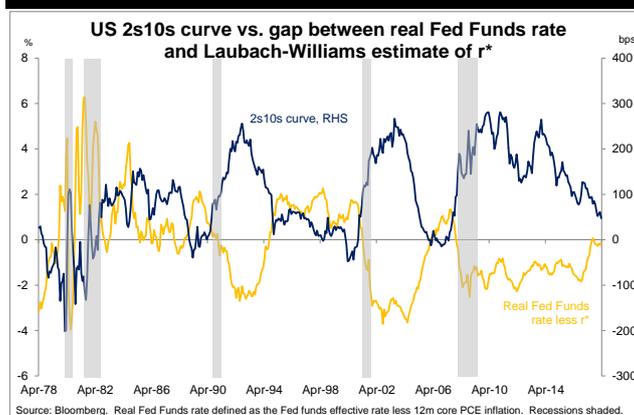
US curves are priced for more flattening

The flattening of the US yield curve over the past two months (to the flattest levels since 2007) has come to the forefront of attention among both market participants and central bankers. Last week, San Francisco Fed President John Williams noted that an inverted curve "is a powerful signal of recessions" while Dallas Fed President Robert Kaplan said last year that the yield curve would be a factor he would consider when deciding on interest rates (a flatter curve implied "a little less operating flexibility at the Fed").

Intuitively, yield curve inversion implies the market prices an easing of US monetary policy in the future, which tends to occur during recessions. Historically, the Fed responds to an 'overheated' economy and higher inflation by hiking interest rates, pushing up the short-end of the yield curve

by more than the long-end and, eventually, restrictive monetary policy leads to recession. The chart below shows the US 2s10s curve tends to invert when the real Fed funds rate is above the Laubach-Williams estimate of the neutral real rate (one sign that monetary policy is in restrictive territory).

US 2s10s curve vs. neutral rate-Fed cash rate 'gap'



The commonly cited 2s10s Treasury curve is around 50bps at present. Moreover, the upward slope of the curve implies the market prices more flattening ahead; the 2s10s Treasury curve is priced to be near 25bps in a year's time.

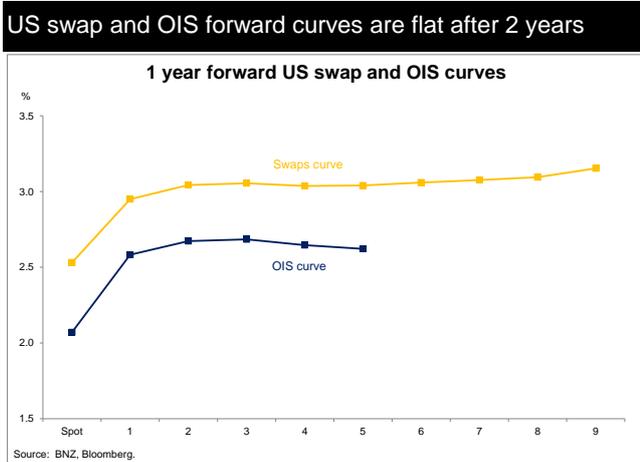
US yield curves are priced for further flattening from here



Differences across curves

The 2s10s swap and OIS curves are even flatter than the Treasury curve. Both these two curves are around 25bps at

present and the forwards imply these will flatten to near zero in a year's time. Essentially, the market prices no tightening from the Federal Reserve beyond two years' time, as reflected in the flat (to very slightly inverted) 1 year forward curves – shown in the chart below.



Although the broader trends across different curve variations are very similar, the levels are somewhat different. Depending on the choice of curve one looks at, you could either draw relative comfort (as John Williams noted, the Treasury curve is some distance above zero) or concern (swaps curves are priced to be around zero in a year's time, which is towards the flattest levels on record).

There are pros and cons when it comes to which curve one looks at. Treasuries are affected by the distribution of supply along the curve and, as cash instruments, are also balance-sheet intensive for banks.¹ The Fed's QE purchases were also directed at the Treasury curve (alongside MBS and agency bonds).

The swaps curve is referenced to Libor, which is influenced by perceptions of bank credit risk and funding pressures, especially at the short-end. The recent increase in funding pressures has seen the swaps curve flatten by more than the Treasury curve.

Arguably, the cleanest measure is the OIS curve, which is both off-balance sheet and is referenced to the Fed Funds effective rate (essentially a "risk-free" rate). The drawback with the OIS curve is the relative lack of liquidity, especially at longer maturities, and the lack of historical data.

Historical experience – US recessions and 2s10s inversion

Here we focus on the 2s10s Treasury curve, both because it has longer data available than the swaps curve and is

¹ Pre-GFC the swap spread curve (between 2 years and 10 years) was almost always upward sloping, whereas it has been downward sloping for the majority of the time since then. This means, post-crisis, the Treasury curve has been steeper than the swaps curve.

typically what market participants refer to when talking about the US curve.

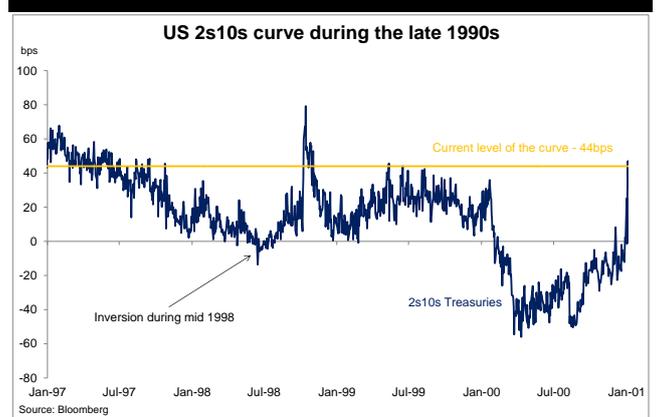
Post-1977, when Bloomberg data on the 2 year Treasury becomes available, there have been five US recessions, as defined by the NBER (admittedly, a small sample). On all five occasions, the 2s10s Treasury curve inverted before recession, with the lead time ranging from around a year to almost two years (the most recent recession).

The lag between curve inversion and recession has varied

Recession start date	2s10s inversion date	Months before recession
Feb-80	Aug-78	18
Aug-81	Sep-80	11
Aug-90	Jan-89	19
Apr-01	Feb-00	14
Jan-08	Feb-06	23

The 2s10s curve gave off one false signal in the late 1990s, when it inverted briefly (but not significantly) during mid-1998, around the time of the Asian crisis and the LTCM bailout.² The Federal Reserve cut rates 75bps that year, but no recession followed.³ The curve remained at very flat levels for several years before properly inverting in early 2000, followed 14 months later by the dot-com recession.

The 2s10s curve inverted briefly in mid-1998



A simple probit model of US recession risk

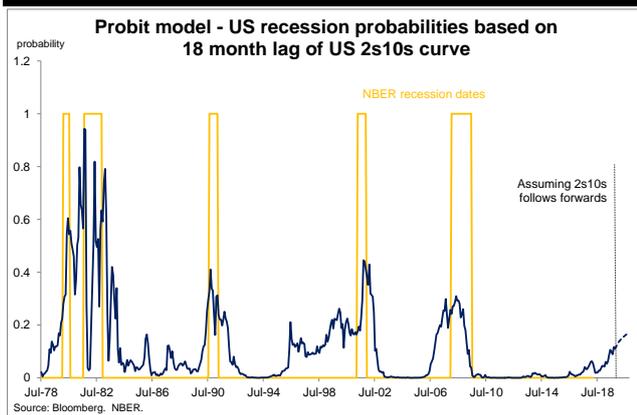
Given the US yield curve's track record in predicting US recessions, we can use a probit model to estimate the probability of US recession risk. Probit models are often used when looking at a binary variable, such as the case of recession (the dependent variable is either "1", in the case of recession, or "0" otherwise). We use monthly data from January 1977 to March 2018, and use an 18 month lag on the 2s10s curve (around the average lead-in time for the past five recessions).

² Long Term Capital Management was a US-based hedge fund that was bailed out by a number of banks in 1998, under the supervision of the Federal Reserve. Interestingly, the swaps curve didn't invert during this time.

³ One could potentially argue that the Fed's easing averted the recession the market was seemingly anticipating.

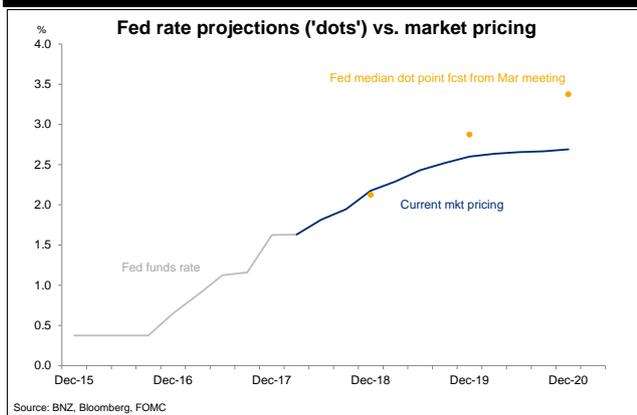
The chart below shows the estimated probability of recession tracks higher over the coming 12 months in line with the recent flattening in the yield curve. Assuming the Treasury curve follows the forwards, and flattens to 25bps in a year's time, the estimated probability of recession rises to around 15% by the end of next year and almost 20% in late 2020. While still low in absolute terms, these recessionary probabilities are quite high in the context of the past 25 years (the estimated probability of recession was around 30% before the last recession).⁴

Probit model of US recession risk – based off 2s10s curve



Of course, the Fed's 'dot plot' projects more tightening than the market has priced – the median Fed projection implies an additional three hikes in 2019 and a further two in 2020 (vs. market pricing of around two hikes over this period – see chart below). Assuming the Fed followed through on its tightening plans over the next three years but market expectations of the longer-run neutral rate were unchanged from present levels, we estimate the 2s10s yield curve would flatten close to zero in a year's time, raising the estimated probability of recession to around 25%.

The Fed projects more rate hikes than the market

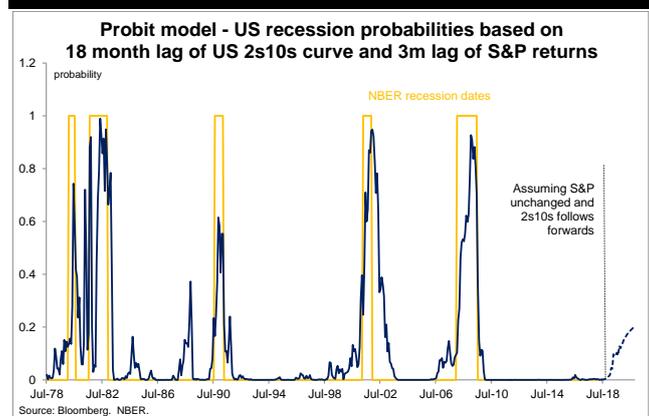


⁴ The estimated probability of recession using the 2s10s swaps curve is higher, owing to the fact that it is towards the lower end of its historic range. The estimated probability of recession using swaps is just below 30% in 18 months' time and near 50% in late 2020. Data on swaps is only available since the late 1980s, in which time there have only been three recessions, so the results need to be interpreted with caution.

We can also incorporate other financial market variables to attempt to improve the predictive power of the model. If we add the 12m change in the S&P500 (lagged 3 months) alongside the US curve, the model shows a better fit.⁵

This version of the model similarly puts the probability of recession at the end of next year around 15%, assuming the 2s10s curve follows the forwards and the S&P500 is unchanged at present levels. The model is quite sensitive to equity returns; a 10% fall in the S&P500 by late next year raises the probability of recession at end-19 to around 30%. A 10bp inversion of the 2s10s curve in the next few months alongside that 10% fall in the equity market raises the probability of recession at end-19 to 50%.

Probit model – based off 2s10s curve and S&P 1y change



Will this time be different?

Historically, there has been a very strong relationship between yield curve inversion and recession. Using the yield curve between 3 months and 10 years, the New York Fed notes that an inverted curve preceded every recession since 1950, with only one exception (in the mid-1960s).⁶

Given its historical track record, it seems dangerous to assume that this time might be any different from the past. The obvious mitigating factor this time around is the Fed's (and other central banks) quantitative easing, which reduced term premia in longer-dated bond yields. A Federal Reserve study from 2017 estimated QE cumulatively lowered the term premium on the 10 year Treasury by around 100bps.⁷

While the Fed is currently in the process of gradually reducing its balance sheet, which should in principle put upward pressure on the term premium, the accumulated stock of its Treasury holdings is still arguably distorting the underlying signal from longer-term bonds, and hence the

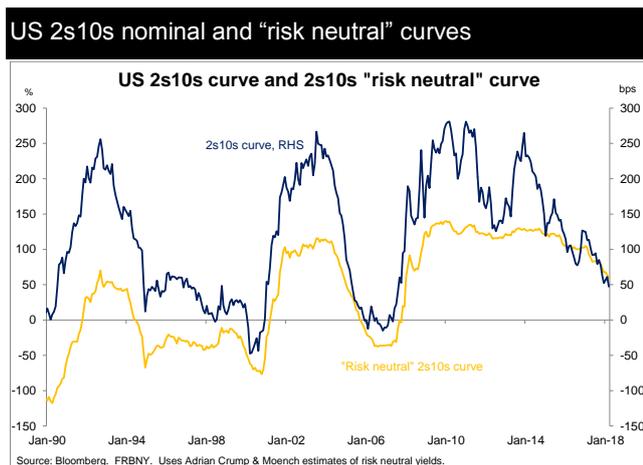
⁵ We experimented with other combinations of variables, including credit spreads and financial conditions, but settled on S&P500 changes owing to model fit and data availability.

⁶ https://www.newyorkfed.org/research/capital_markets/vcfaq.html#Q1

⁷ <https://www.federalreserve.gov/econres/notes/feds-notes/effect-of-the-federal-reserves-securities-holdings-on-longer-term-interest-rates-20170420.htm>

yield curve. The 10 year term premium – based on the ACM model – is almost -50bps at present.

If we strip out these estimates of term premia from the 2 and 10 year yields, and instead look at the “risk neutral” slope of the 2s10s curve, it is steeper than the nominal Treasury curve, at 60bps (shown by the yellow line below). The optimistic view would be that the 2s10s “risk neutral” curve is relatively steep by historic standards, implying a low chance of recession.⁸



While we have some sympathy with the view that QE might be distorting the signal from the yield curve at present, it’s worth noting that various explanations have been proposed in the past to “look through” yield curve inversion. In the mid-2000s, then Fed Governor Ben Bernanke’s thesis about the “global savings glut” and reserves accumulation among emerging market central banks were seen to be factors keeping long-term yields low. In the late 1980s, researchers pointed to the trend decline in inflation expectations as a reason to be cautious about interpreting the inversion of the nominal Treasury curve.⁹ In both instances, recession followed.

Looking ahead

Looking ahead, the Fed seems likely to hike the Funds rate another two to three times this year based on its current projections. All else equal, further Fed tightening should flatten the curve over the course of the year (as the forwards are pricing). Offsetting that to a degree, we think there is room for the market to revise up its expectation of the longer-run neutral Fed funds rate and we expect Fed balance sheet reduction to push up long-end term premia in time. It’s quite conceivable the yield curve could remain at relatively flat levels for an extended period, much like what happened in the mid-1990s.

Would a flat to inverted yield curve cause the Fed to halt its tightening plans? Recent commentary suggests the yield curve is on the radar of Fed officials and an inverted curve would probably give some members pause for thought. However, with the Fed still viewing the neutral rate as close to 3% (rather than ~2.5% as market is pricing) and the accumulated stock of QE holdings seen to be artificially holding down long-term yields, there seems a good chance the Fed ploughs along with its tightening path even if the curve goes inverted. In such a scenario, the historical record would suggest a recession lies ahead.

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⁸ We would caution that term premium is not directly observable, so we are reluctant to overplay the relative steepness of the “risk neutral” Treasury curve.

⁹ https://fraser.stlouisfed.org/files/docs/historical/frbsf/frbsf_let/frbsf_let_19890310.pdf

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