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Is the yield curve pointing to recession?

What yield curves and credit markets reveal about future growth

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Key points

- The yield curve has been a good predictor of recessions. The last eight have been preceded by material flattening or inversion.
- This appears a causal relationship, suggesting the signal from the curve should remain relevant even if the causes of curve flattening are different this time.
- The yield curve slope proxies the degree of monetary policy accommodation and is key in determining credit conditions.
- Two channels appear relevant. The slope of the curve statistically causes changes in bank lending standards. It also helps determine changes in credit spreads. Both channels work with two year lags.
- Recession probability models suggest that we will not see a recession over the next 12-months.
- We expect credit spreads to widen by 30 basis points in 2019 and 2020, which should reduce growth by 0.7 percentage point (ppt) and 0.8ppt respectively.
- This material headwind to growth, alongside a fading fiscal stimulus, is likely to leave the US economy vulnerable to a material slowdown in 2020.

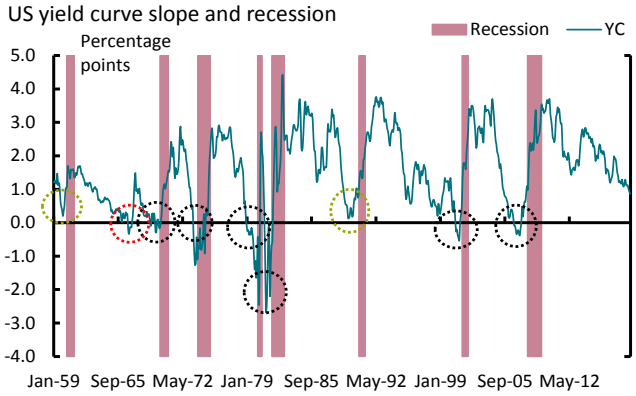
The curve and recessions

A tightening of US monetary policy has resulted in the US yield curve becoming flatter. With the Federal Reserve (Fed) expected to continue its policy of gradual rate increases over the coming quarters, a key measure of the yield curve slope, the difference between the ten-year and two-year US treasury yields, has recently reached its smallest since July 2007. In the following, we consider what we can learn from the yield curve about the outlook for future economic activity.

Historically, the slope of the yield curve has b5een a good indicator of future recessions. Exhibit 1 illustrates this historic relationship since the 1950s. Over that time, the US has suffered eight recessions. The yield curve has flattened[1] into each of those events. In six of these instances the yield curve inverted before the recessions, but failed to do so in 1960 and 1990. There has only been one instance in that period when yield curve inverted and the economy did not fall into recession – this occurred in 1966. The economy did fall into recession at the start of 1970, but only after a timelier inverted curve signal in July 1969. The curve also flattened substantially, although did not invert, in the late 1990s before inverting fully in August 2000, just ahead of the 2001 recession.

[1] As measured by the difference between the 10-year US treasury yield and 3m-LIBOR rate, not the 10-year and 2-year differential.

Exhibit 1: Inverted curve is a good indicator of recession



Source: Bureau of Economic Analysis (BEA), Federal Reserve Bank (FRB) and AXA IM R&IS calculations, Oct 2018

The slope of the curve has also offered a reasonably consistent early warning signal. Exhibit 2 illustrates the differences in timing between yield curve signals and economic downturn. The difference between the yield curve inversion (or minimum) and recession (as defined by the National Bureau of Economic Research (NBER) recession dating process) has ranged between five and 17 months. The time lag has increased in recent decades. There is a somewhat greater variability between the point of inversion (or minimum) and the first contraction in quarterly economic output. This ranges between one and 16 months. Over the past four decades, the yield curve has, on average, provided about 12-months warning to the start of recession/first contraction in quarterly GDP (13.4 and 11.8 months respectively).

Exhibit 2: Curve provides consistent early warning

Inversions	Recession start	GDP contraction	Lag from recession	Lag from contraction
*Dec-59	May-60	Apr-60	5	4
Jul-69	Jan-70	Oct-69	7	3
Jun-73	Dec-73	Jul-73	7	1
Dec-78	Feb-80	Apr-80	15	16
Nov-80	Aug-81	Apr-81	10	5
*Jun-89	Aug-90	Oct-90	15	16
Aug-00	Apr-01	Jan-01	9	5
Aug-06	Jan-08	Jan-08	18	17
Average	-	-	11	9
Minimum	-	-	5	1
Maximum	-	-	18	17

*Indicates the date whereby the curve didn't invert

Source: BEA, FRB and AXA IM R&IS calculations – As of October 2018

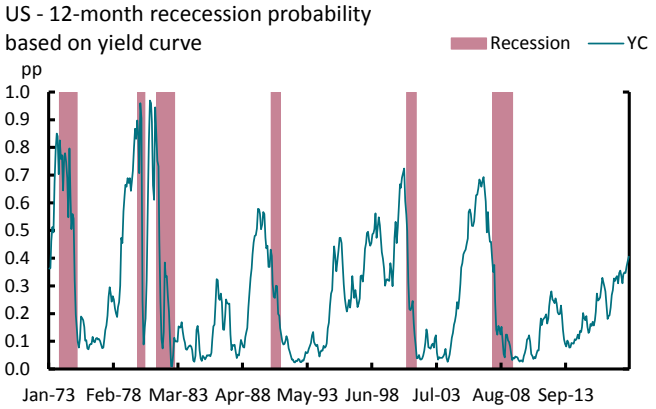
On our preferred measure of yield curve slope, the curve remains some way from inversion – currently at 73 basis points (bps). On our forecasts the curve is only likely to come close to inversion towards the end of next year, perhaps signalling difficulties for 2020 or beyond. However, a number of questions can be raised about the integrity of any signal sent from the yield curve at this time, because the Fed (and other international central banks) is deliberately manipulating longer-term market rates and term premia through their asset holdings. In the following we ask:

- Does the slope of the yield curve provide incremental information about future activity, or is it a binary warning of recession or not?
- Is this time different? Do a negative term premium and/or expectations of future declines in neutral rates distort the yield curve signal?
- Is the yield curve just another barometer of economic activity or is there a deeper, more causal relationship between the two?

The probability of recessions

To assess whether the slope of the yield curve offers continuous information about the outlook for activity, we estimate a 'probit' model. This estimates the probability of binary outcomes (recession or not) from continuous data. Exhibit 3 illustrates our simple estimation of the probability of recession over the next 12-months using just the 3 month-LIBOR/10-year treasury rate differential.

Exhibit 3: Slope shows increasing probability of recession within 12 months



Source: BEA, FRB and AXA IM R&IS calculations, Oct 2018

Our simple model shows that the yield curve slope indicates a rising probability of recession ahead of the recession events of past decades. Historically recession probabilities around 60% have been followed by recessions. However, it also shows how this signal alone pointed to a high probability of recession (approaching 60%) in the mid-1990s that did not ultimately emerge. This is consistent with the casual observations made from Exhibit 1[2].

Research from the US Fed[3] also suggested that probability models of recessions can be enhanced by considering

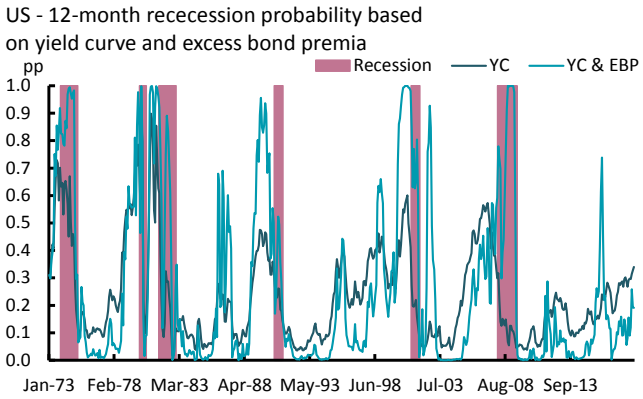
[2] We also tested the predictive power of the yield curve to capture recessions over the coming 24-months. This provided no more meaningful insights, with probability levels spiking, albeit to higher threshold levels, at the same points as in 12-month models.

[3] Johansson, P. and Meldrum, A., "Predicting Recession probabilities Using the Slope of the Yield Curve", Feds Notes, 2018

additional information from credit markets. Following this research, we also estimated a probability model based both on the slope of the curve, as above, and the excess bond premium[4] (EBP), shown in Exhibit 4.

The inclusion of this excess bond premium in most instances appears to send a clearer recession signal. The probabilities of recession associated with the 1990s, 2001 and 2008 recessions all rise to in excess of 90% when the model includes the EBP. This more clearly distinguishes, for example, the recession signals from the mid-cycle signals in both the 1980s and 1990s. However, in other ways, the EBP inclusion also confuses the outlook. Mid-cycle recession probabilities rise to suggest near 70% probabilities of recessions, that are false positives in 1980s, 1990s and again in 2015. Moreover, the probability of a recession during the financial crisis did not emerge until September 2008 – 10 months after the recession began.

Exhibit 4: Probability of recession signal enhanced by credit market metrics

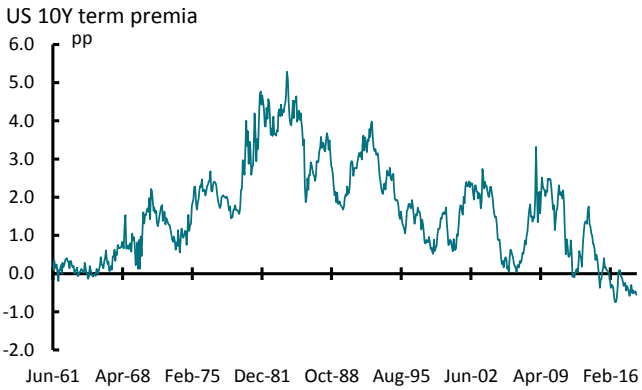


Source: BEA, FRB and AXA IM R&IS calculations, Oct 2018

Are Fed actions likely to distort the signal for future economic activity?

The Fed's quantitative easing programme was deliberately intended to compress term premia and create a portfolio redistribution effect, encouraging investors to shift holdings along the credit spectrum. However, with term premia still negative (Exhibit 5) despite the Fed being one year into the process of unwinding of its asset holdings, an inverted curve today would send a different message from those sent in the past. Historically, an inverted curve would have meant the current policy rate was higher than future expected policy rates and was hence a key signal of impending economic deceleration. With a negative term premium, future policy rates would not necessarily be lower than current policy. Relatedly, broader expectations about the future of interest rates may be different now. We expect future neutral rates to rise over the coming few years, but fall over the longer term, largely reflecting demographic factors[5]. If this view is shared in markets, it would point to a downward sloping yield curve. As such, an inverted curve now could reflect longer-term structural, rather than short-term cyclical, expectations.

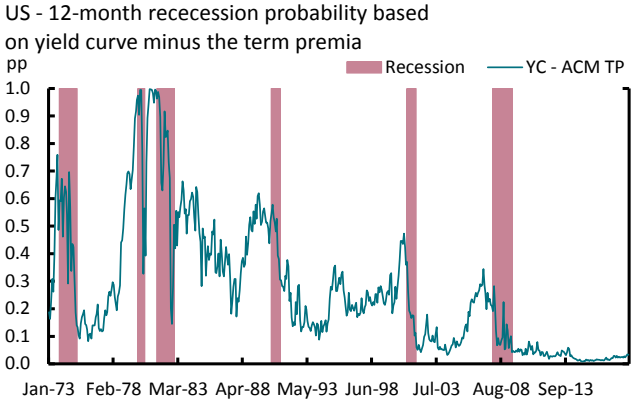
Exhibit 5: QE has helped depress term premia



Source: FRB and AXA IM R&IS calculations, Oct 2018

We test whether shifting term premia would alter the yield curve signal by re-estimating the recession probability model allowing for the decline in term premia[6]. Exhibit 6 shows that this is not a useful model. The decline in term premia seen since the start of the 1980s has had a similar effect on the probability of recession with each recession predicted with less and less conviction and later recessions signalled with less probability than false positives earlier in the sample. Moreover, we note that the early 1960s was also a period of compressed term premia, but the yield curve signal still proved relevant then. Both suggest the yield curve signal should not be affected by lower term premia.

Exhibit 6: Estimating a term premia-corrected recession probability



Source: FRB and AXA IM R&IS calculations, Oct 2018

Accordingly, it may not matter why the yield curve slope flattens, it is still likely to precede weaker growth. This would be the case if the yield curve slope actually played a causal

4 Excess Bond Premium is calculated as the difference between the degree of credit spread associated with the current default risk and total spread.

5 Page, D., "The best guide for US treasury yields points upwards", AXA IM Research & Strategy Insights, 22 March 2018.

6 We estimate the 3m-LIBOR and (10-year US treasury minus term premia) differential.

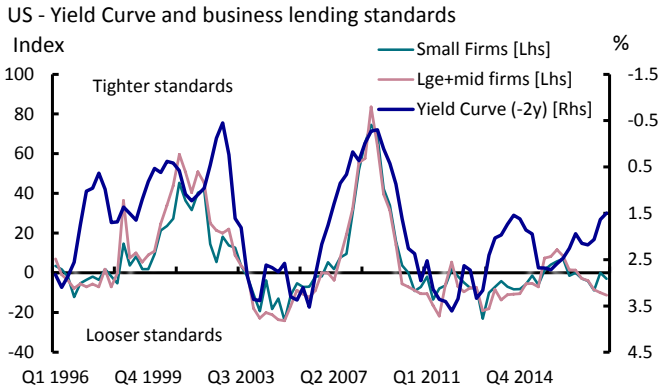
role in generating economic slowdowns and was not simply a timely barometer.

Yield curve influences lending conditions

We postulate that a flatter curve reduces the profitability of the maturity transformation service that the banking sector performs (banks borrowing short and lending long). This lower profitability should reduce the incentive for banks to lend (or at least see them increase the cost of doing so).

We test this theory by looking at the change in bank lending conditions, as reported by the Fed's Senior Loan Officers Survey (SLOOS).

Exhibit 7: Yield curves steer bank lending conditions to business



Source: FRB SLOOS and AXA IM R&IS calculations, Oct 2018

Exhibit 7 shows bank lending conditions for large, medium and small firms recorded in the SLOOS. These conditions tighten as the yield curve slope flattens (reducing profitability), where the relevant yield curve slope is lagged by two years. These results were consistent with different metrics of lending conditions, including the spread over the cost of funding that banks charge businesses for lending and for lending conditions to the household sector. This appears to confirm that a flattening of the curve reduces commercial banks incentives to lend and results in an associated tightening in lending standards.

To provide a more rigorous analysis of this effect, we tested whether the slope of the yield curve (lagged by two years) statistically caused a tightening in bank lending conditions[7]. Exhibit 8 records our results. In each instance of lending the yield curve slope proved highly statistically significant[8]. While we accept that these tests are for a very narrow form of statistical causality, they add to our conclusion that the slope of the yield curve is indeed likely to contribute to the slowdown in economic activity, via a tightening in credit conditions as opposed to being a simple barometer.

Exhibit 8: Evidence of causality

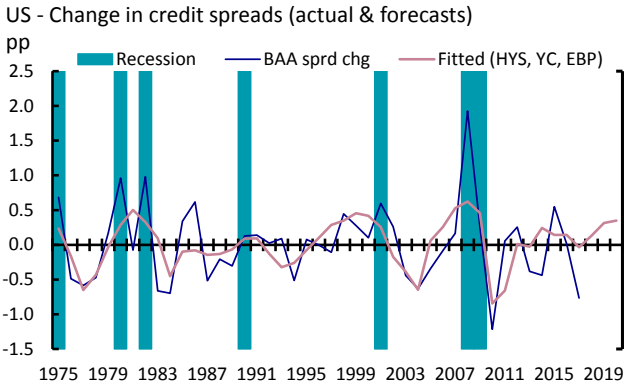
		BBA Spr (1Q lag)		YC (2y lag)		YC exc.06-10 (2y lag)	
		P-Value	Causal	P-Value	Causal	P-Value	Causal
Household lending	Credit card	0.987	No	0.00	Yes	0.00	Yes
	Non-credit card	0.291	No	0.00	Yes	0.00	Yes
Tighter standards	Small	0.322	No	0.00	Yes	0.00	Yes
	Large +mid	0.068	No	0.00	Yes	0.00	Yes
Increasing spreads	Small	0.909	No	0.00	Yes	0.00	Yes
	Large +mid	0.305	No	0.00	Yes	0.00	Yes

Source: Datastream and AXA IM R&IS calculations – As of September 2018

Credit spreads contain more information about the future

The yield curve also looks to contribute to tightening conditions in credit markets. Fed research[9] concludes that credit spreads contain a predictable, mean-reversion element. This suggests that after periods of excessively tight (loose) credit spreads, accompanied by high (low) high-yield issuance, credit spreads will normalise over the following two years, with spreads rising (falling) towards more historic norms. Given the contemporaneous impact of credit spread movements with economic activity, this suggests an influence on GDP growth two years ahead. We re-estimate and refine the Fed's original model for future spreads.

Exhibit 9: Predicting future credit spreads



Source: Datastream and AXA IM R&IS calculations

Exhibit 9 illustrates the actual and predicted change in BAA credit spreads using a model solely based on two-year-lagged information. We estimate movements in BAA spreads by

[7] Specifically we tested for Granger causality.

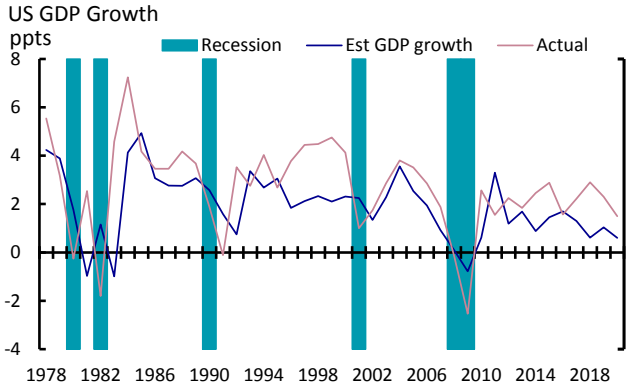
[8] We also tested whether this might have been dominated by the influence of the financial crisis by excluding the period 2006-2010 from the analysis. The yield curve still proved highly statistically significant. We finally tested more contemporaneous short-term credit events to see if these could explain changes in lending conditions. This hypothesis was rejected in each case.

[9] Lopez-Salido, D., Stein, J. and Zakrajsek, E., "Credit-Market Sentiment and the Business Cycle", FRB, 2015

using the excess bond premium[10], the slope of the yield curve and the high-yield share of total bond issuance from two years before. Our model suggests that just over one-third of the future movement in credit spreads can be explained by these lagged variables (34.5%).

We then estimate the impact this change in predicted spreads has had on GDP growth by creating a simple model of growth based on the previous year's activity and this predictor of future credit spreads[11] (Exhibit 10). The predicted component of credit spreads is statistically significant. It also suggests that for an 11bps increase in predicted credit spreads, GDP growth is reduced by 0.25ppt.

Exhibit 10: Forward-looking credit spreads help predict GDP growth



Source: FRB and AXA IM R&IS calculations, Oct 2018

From this we can draw two conclusions about the outlook for spreads and GDP over the coming two years. First, our model points to a rise in BAA credit spreads of around 30bps in both 2019 and 2020 based on data for the first three-quarters of this year. Second, that such a rise would reduce growth by 0.7 and 0.8ppt in 2019 and 2020. This suggests a meaningful headwind to growth over the coming two years associated with the tightening in spreads.

Moreover, our model uses the same variables (with the inclusion of the share of high yield issuance) to estimate the predictable component of spread moves as are used to predict recession probability over the next 12-months. Again this highlights the causal channel through which the yield curve slope affects credit conditions.

Summary and outlook

The yield curve slope has been a powerful signal of impending economic slowdown. The eight recessions in the US since the 1950s have each been preceded by a material flattening or inversion of the US yield curve.

Our analysis has shown that while a simple probability model of US recessions using the slope of the yield curve provides a clear signal of recessions over the coming 12-months. Enhancing the yield curve signal with other credit market indicators provides a more refined signal.

We suggest this reflects causal relationships. Changes in the yield curve slope result in a tightening in bank lending standards two years later. The yield curve and credit market indicators also result in predictable reversals of credit spreads two years later. In both instances, the tightening of credit standards that follows a shift in the yield curve slope would be expected to have a material impact on economic activity.

To some extent, this simply illustrates the transmission of monetary policy. Our measure of the yield curve slope - the difference between the 3 month-LIBOR rate (reflecting current policy) and 10-year US treasury rates (driven primarily by neutral rates) – reflects the degree of policy accommodation or restrictiveness. It is no surprise that tighter monetary policy leads to more restrictive credit conditions that in turn slow economic activity. This is indeed the purpose of monetary policy.

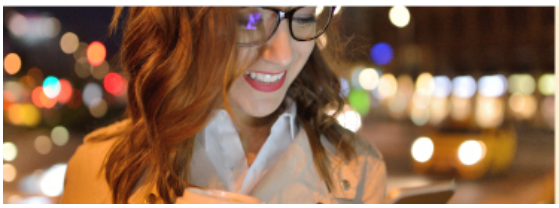
Yet our analysis goes further than simply providing a quantifiable relationship for this transmission mechanism. Beyond simply stating whether there is a low or elevated chance of recession over the coming 12-months, our model suggests the scale of adjustment we should expect in credit spreads over the coming two years and the likely impact on economic activity. Based on data to the end of the third quarter of 2018, we forecast a 30bps widening in BAA spreads in 2019 and 2020. We estimate this will reduce GDP growth by 0.7ppt and 0.8ppt respectively.

While our probability model suggests that a recession within the next 12-months is unlikely, these longer-term forecasts suggest a material headwind to economic growth in 2020. Coupled with the fading fiscal boost and growing tensions in trade policy, we suggest that the US economy will be vulnerable to a material slowdown in 2020.

[10] We also estimate a model that replaces the EBP with a cumulative spread over/undershoot of trend metric. Swapping this provides an alternative explanatory variable and one which captures the sharp rise in credit spreads around the time of the financial crisis better, although the original specification performs better over the sample period as a whole.

[11] Using the predicted component of spread changes is important. A simple analysis of credit spreads illustrates that they are highly significant determinants of growth. Focusing on this predicted component illustrates that it is the historic, predictable element of credit spreads that has an impact on growth two years later, not simply credit markets anticipating current developments more quickly than GDP data.

Our Research is available on line:



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