

Poland Economics View

What can the yield curve tell us?

- Significant flattening of the curve in 2019, followed by a recent steepening, raises questions regarding the predictive power of the shape of the yield curve.
- Our econometric analysis suggests that although the swap curve can sometimes be helpful in predicting periods of substantial slowdown in Poland, some caution is warranted when interpreting such signals.
- Even the best model correctly highlights only 44% of the actual periods of 'weak growth'. This is a disappointing outcome as, in our view, it makes sense to assume that the model would be even less successful in out-of-sample forecasts.
- With this caveat in mind, our estimates imply close to 40% probability of economic growth below 0.4% QoQ in mid-2020.
- As a rule of thumb - our estimates suggest also that a 10bps flattening of the curve would imply an increase in the likelihood of 'weak growth' by ~2% points.

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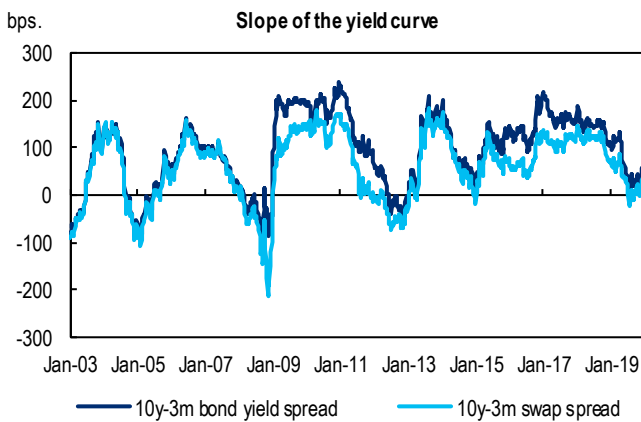
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What can the yield curve tell us?

After significant flattening during 2019 the bond curve is steepening again. The slope of the curve, measured by the spread between ten year Polish government bonds and three month money market rate, fell from 113 bps in early 2019 to around 1bps in August and then rose again to the current level of 62bps (Figure 1). We believe it is worth considering to what extent the flattening of the curve in Poland can be treated as a signal of future substantial slowdown. Various research shows that the US Treasuries curve can be a useful indicator of recession risks in the US and many investors we talked to over last year appear to believe this is true also for Poland.

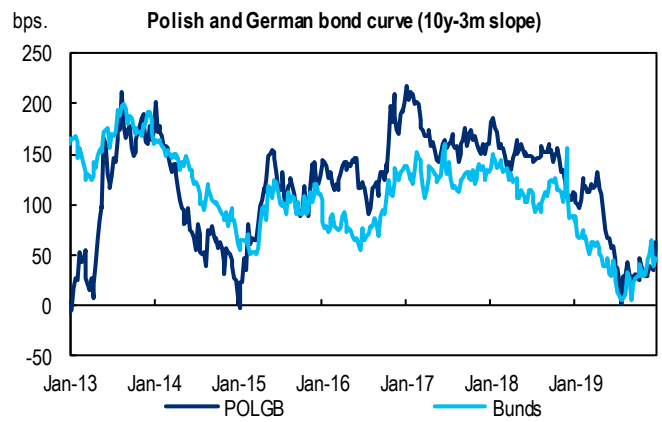
Whether yield curve can predict periods of deep slowdown in Poland is a question that can only be answered empirically. Even if there is a link between economic activity and the shape of the yield curve in advanced economies, there is no guarantee that such a link will be present in Poland as well. Furthermore, the slope of the Polish curve is correlated with spreads in core markets' (Figure 2) and therefore these moves may simply reflect changes in the global sentiment, rather than domestic factors. In order to check the curve-GDP link we run a number of econometric models that are designed to estimate probability of a recession or a slowdown based on the evolution of the slope of the curve (see Appendix for details).

Figure 1. 2019 saw substantial flattening of the yield curve in Poland



Source: Bloomberg, Citi Handlowy Research

Figure 2. Slope of the POLGB curve is highly correlated with the slope of the bund curve



Source: Bloomberg, Citi Handlowy Research

Our analysis suggests that the Polish yield curve indeed has some predictive power but this power is smaller than is frequently argued. Figure 3 presents estimated parameters from thirty models. The row (1) refers to models that aim to predict probability of a contraction in GDP (GDP growth below 0%), while the rows (2) and (3) refer to predictions of economic slowdown to or below 0.2% QoQ and 0.4%, respectively. The analysis is repeated for various forecasting horizons ranging from the current quarter to four quarters ahead. The table shows that the slope of the curve provides little useful information about the risk of a GDP contraction, as model parameters are not even statistically significant. Somewhat more encouraging are results from the third row of Figure 3. The estimated parameters are statistically significant for equations providing forecasts for the current period as well for the period two quarters ahead. These results deserve some comment.

Figure 3. Parameters of estimated logit models for predicting the probability of recession/weak growth

	Current quarter	Slope of bonds curve				Current quarter	Slope of swap curve			
		Quarter T+1	Quarter T+2	Quarter T+3	Quarter T+4		Quarter T+1	Quarter T+2	Quarter T+3	Quarter T+4
(1) GDP contraction	-0.29	-0.11	-0.25	-0.28	-0.44	-0.46	-0.31	-0.49	-0.43	-0.54
(2) Growth not exceeding 0.2% QoQ	-0.40	-0.37	-0.52	-0.33	-0.24	-0.58	-0.60	-0.81 **	-0.47	-0.35
(3) Growth not exceeding 0.4% QoQ	-0.94 **	-0.66 *	-0.81 **	-0.52	-0.16	-1.23 ***	-0.84 *	-1.06**	-0.65 *	-0.23

Source: Citi Research estimates. Note: Table shows estimated parameters of slope variables in logit models. Each column refers to different model, providing forecasts for the current period or 1, 2, 3 and 4 quarters ahead. *** parameters statistically significant at 1% level; ** statistically significant at 5% level, * statistically significant at 1% level

- The fact that the shape of the yield curve in a given quarter indicates higher probability of weak growth in the same quarter is hardly useful. What market participants look for, are indicators that are forward looking, providing some information on future, not current economic conditions. After all, in order to assess the growth in T0 the investors can rely on hard data (for example monthly data on industrial output, retail sales or construction output) or on the business confidence indicators from that period. The shape of the yield curve is probably a reflection of what these indicators are already showing. Therefore from a forecasting point of view, much more interesting are those models that are successful in estimating the risk of slowdown at least one or two quarters in advance. The two models that meet this condition are those that predict the probability of a slowdown two quarters ahead (bolded entries in Figure 3).
- For these two equations we checked also to what extent the positive results are a byproduct of strong links between Poland and Germany. It may be the case that the Polish curve simply reacts to changes in the shape of the Bund curve, while the Polish economy reacts with a delay to changes in German growth. In such a situation the Polish bond/swap curve would offer little additional information beyond what can be extracted from German bonds. In order to check this we used in our models adjusted explanatory variables¹. The results are reassuring as they suggest that even after adjusting for the impact of the foreign yield curve, the slope of Polish swap and bond curves still has predictive value.
- How useful are these models? The models are supposed to be good indicators of the coming slowdown and therefore they should be assessed from this point of view. The mere fact that their parameters turned statistically significant is not enough. Therefore we compared signals sent by the two selected models with the actual growth outcomes, which allowed us to assess their predictive power². The bond curve model fails this test as it performs worse than a naïve forecast. In turn the model based on swap curve performs better and with a lead of two quarters it correctly highlights 44% of the actual periods of 'weak growth'. This is, however, still a relatively disappointing outcome, especially given the fact that the predictive power was checked on the sample on which equations were estimated. In our view it makes sense to assume that the model will be even less successful in out-of-sample forecasts.

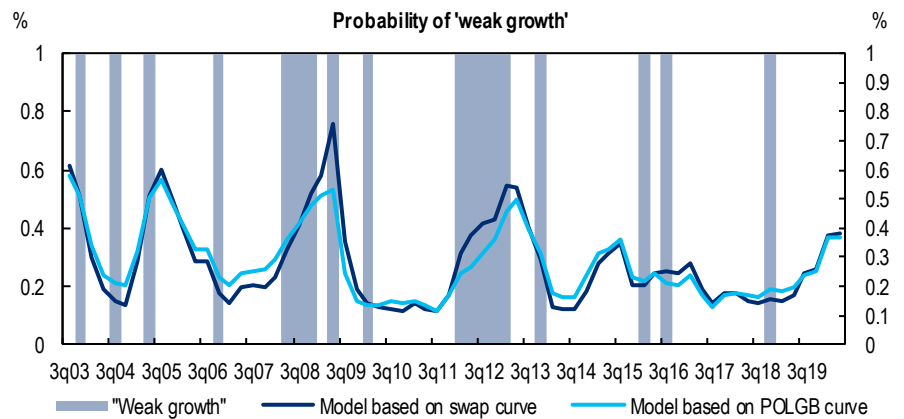
¹ Instead of using Polish 10y-3m spread we used residuals from the regression of that spread on German curve slope.

² For this purpose we assumed that whenever a model produces 40% probability of 'weak growth' over next two quarters, we can treat it as a signal that should be compared with the actual growth outcomes.

All in all, our results suggest that although the swap curve can sometimes be helpful in predicting periods of substantial slowdown in Poland, some caution is warranted when interpreting such signals. Having said that, we note the estimates based on the most recent data implies close to 40% probability of economic growth below 0.4% QoQ in mid-2020 (Figure 4).

If one decides to use the model despite all these potential issues and concerns, the key question is how a given change in the slope would affect the probability of 'weak growth' outcome. Our estimates suggest that a 10bps flattening of the curve would imply an increase in the likelihood of 'weak growth' by almost 2% points³. With all caveats, this may provide a useful rule of thumb for interpreting changes in the shape of the Polish swap and bond curves.

Figure 4. Yield curve models suggest increased probability of weak (below 0.4% QoQ) growth within next two quarters



Source: Citi Handlowy Research estimates. Note: Periods of 'weak growth' are defined as periods when GDP growth was at or below 0.4% QoQ.

³ Average partial effect for the logit model was estimated at 0.19.

Appendix – Additional technical details

The time series of national accounts data for Poland starts in 1995, which means there are less than 26 years of reliable GDP growth statistics. However due to limited availability of yield curve data and due to the fact that the earlier period of economic transformation is not informative about present economic links, our analysis covers a shorter sample - 2003-2019. Over that period of 67 quarters there are only seven quarters with negative GDP growth (10.6% of the sample), which is too low a number to allow for reliable statistical results. For comparison, in other countries the share of quarters with negative growth is usually higher: 21% in Germany, 23% in Spain and 32% in Italy (Figure 5). Therefore in our analysis we look not only at periods when growth in Poland was negative but also at periods when quarterly growth was less than or equal to 0.2% and 0.4%. As a reference point, the average quarterly growth in this period amounts to 1% QoQ. For each of these cases we created a binary variable which takes value 1 in a quarter with weak growth ($\leq 0\%$, 0.2% and 0.4% QoQ).

Figure 5. Share of quarters with low GDP growth in selected EU countries (%), 1Q 2003-3Q 2019)

	Czech R.	France	Germany	Hungary	Italy	Netherl.	Poland	Romania	Spain	UK
Quarters with GDP growth below 0% QoQ	14.3	13.6	21.2	16.6	31.8	18.1	10.6	12.8	22.7	11.3
Below 0.2%	16.6	27.2	33.3	22.7	53.0	28.7	15.1	13.6	31.8	19.6
Below 0.4%	27.2	51.5	43.9	25.7	74.2	42.4	22.7	19.6	36.3	34.8

Source: Citi Research estimates based on Eurostat data

As explanatory variables in our models we use either: the spread between ten year government bond and a three month money market rate (WIBOR3M) or the spread between ten year swap and WIBOR3M. We try to assess the predictive power of the slope of the curve for several forecasting horizons, up to four quarters ahead.

We use logit models that allow us to estimate the probability of 'weak growth' (probability that the binary variable takes value 1). Figure 3 shows the estimated parameters of the respective models depending on what type of yield curve we use (bond or swap curve) and depending on the forecasting horizon.

In logit models the impact of explanatory variables (slope of the curve) on the probability of the outcome (quarter with weak GDP growth) is calculated as $f(\mathbf{x}'\mathbf{b})\mathbf{b}$, where $f(\mathbf{x}'\mathbf{b})$ is the density function of the logistic distribution. For the model with the most reliable results the average partial effect (APE) was estimated at approx. 0.19.

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