Macro Theme

AI central bank watching: Bank of England

Central banks spend considerable amounts of time explaining and communicating their policies. Sometimes, as in the case of forward guidance, the explanation even is the policy. To isolate and quantify the relevant signals from the flood of communication that financial market participants are faced with in an instant, we apply machine learning techniques to central bank minutes. In this report, we introduce the application of our text analysis tools to the Bank of England.

Latest addition to our central bank text analysis arsenal

In addition to our models on the Fed, the ECB and the Riksbank, which we have presented in an extensive earlier report, we now include text analysis models for analysing communication from another major central bank, the Bank of England (BoE). The machine learning technique-based measures allow us to objectively and rapidly analyse the content of the Monetary Policy Committee (MPC) minutes.

Measuring content, sentiment, hawkishness and uncertainty

We present five indicators to capture various dimensions and intensions of BoE communications. Firstly, we use a model to assign topics to each minute. Secondly, we compute a sentiment score to measure the tone of the texts. Thirdly, we derive the implied uncertainty about the outlook using lexical innovations. Fourthly, our Hawk-o-Meter provides a prediction of what the next rate move will be. Lastly, as a special feature for the BoE, we introduce a Brexit-o-Meter, which measures the uncertainty in the discussions relating to Brexit. More detailed explanations of the various measures can be found in the technical appendix at the end of this report.

Follow us for instant AI central bank watching

The results of the model for the Bank of England, but also the Fed, the ECB and the Riksbank, are published immediately after the text is released and processed, ie within a few minutes. To be instantly updated, you can follow @NordeaMacroLab via Twitter or your Bloomberg terminal. The outputs will, of course, also be used in our regular central bank analysis notes.

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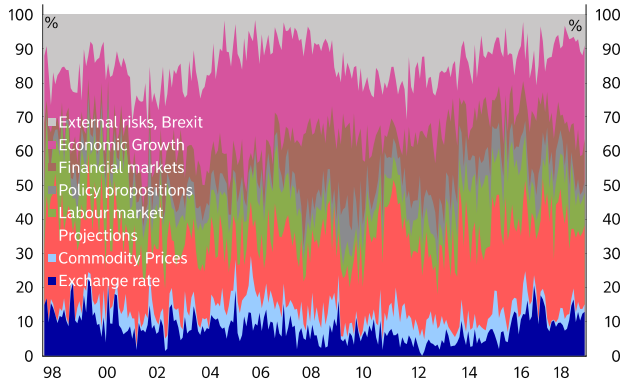
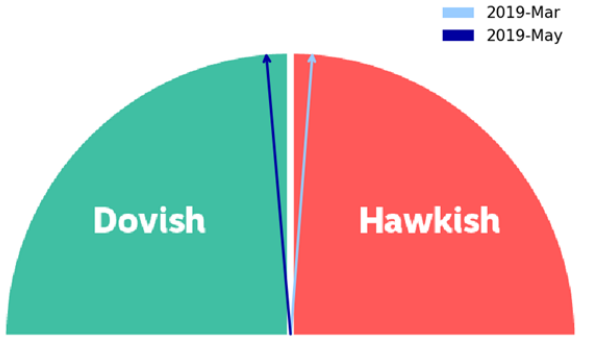
TOPIC DISTRIBUTION OF BOE MINUTES



Source: Macrobond and Nordea

BOE HAWK-O-METER



Source: Macrobond and Nordea

Reading the Bank of England

Our machine learning models can give a preliminary analysis of new minutes from the Bank of England within just a couple of minutes. We will publish our results through Twitter @NordeaMacroLab, and they can also be seen on Bloomberg.

We use all the monetary policy minutes from September 1997 to May 2019 to train a model to find eight topics in the text. The chart below shows the topic distributions – the percentage of the minutes devoted to that topic.

The MPC likes to discuss economic growth and projections

There are two topics that generally dominate the minutes: economic growth and projections. The paragraphs likely to deal with economic growth usually tend to discuss the latest GDP data, as well as other indicators of economic growth, such as PMI and consumer confidence. The topic occupied around a quarter to a third in each of the minutes between around 2004 and 2008. Recently, the topic has gained importance again as the Monetary Policy Committee (MPC) tries to assess the risks that Brexit poses to economic growth. Projections are a slightly different topic, with discussions revolving around forecasts.

Where's inflation?

There is no obvious inflation topic as there has been in the topic models for the Fed, the ECB and the Riksbank. Instead, discussions about inflation have mainly been embedded into the projections topic, where they have dealt with, among other things, inflation expectations, to what extent targets have been met, what recent readings have been and where inflation is headed. Other inflation-related discussions have concerned commodity prices, especially regarding the contribution of oil and food prices to CPI.

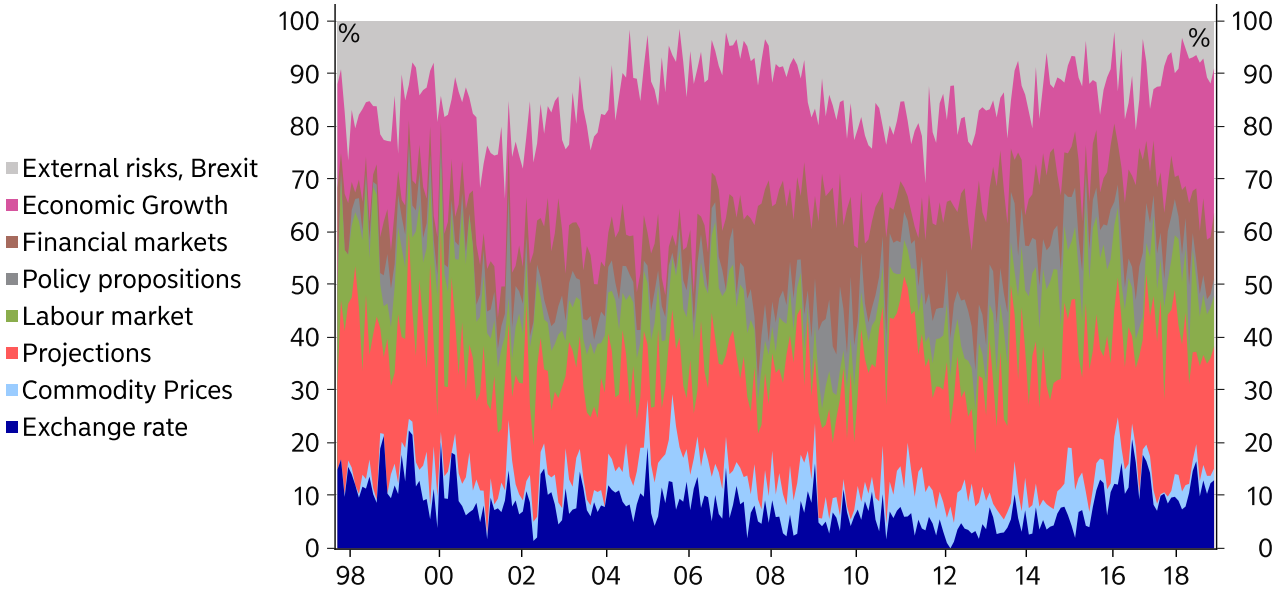
Financial markets gained prominence after the crises

As expected, the discussions about financial markets increased markedly during the financial crisis and the euro crisis. Also, the topic of external risks gained in importance in the minutes from around 2008 and onwards. We also see that exchange rates have attracted more attention in recent years, mainly due to the depreciation of the sterling in the years following the referendum on leaving the European Union.

Brexit has not made a big impact in the topic model just yet

Brexit has been an important topic since the start of 2016 but has not become a topic of its own in our model. The reason for this is that the discussions have mainly been in relation to some of the other topics; a lot of focus has been devoted to the effect on the exchange rate and economic growth. To add some insight to the discussions on Brexit, we have developed a separate Brexit-o-Meter.

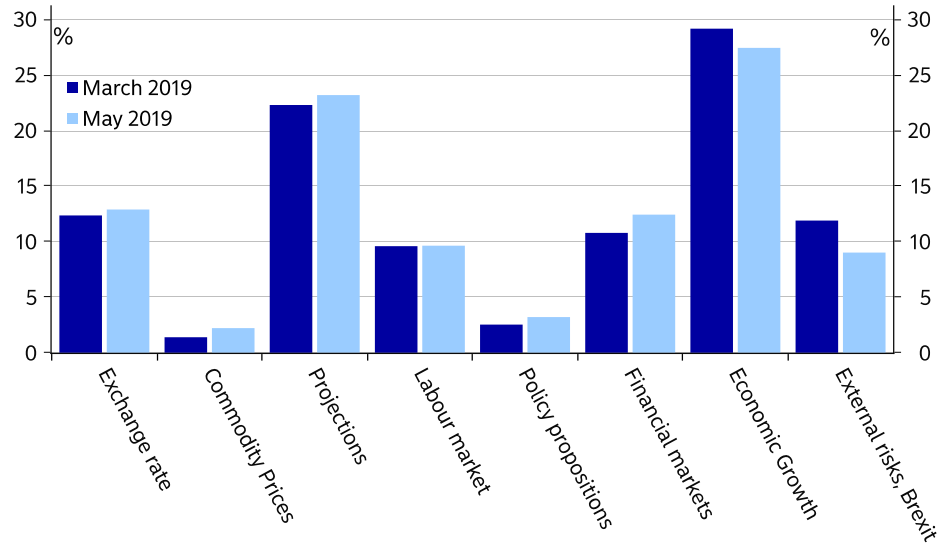
TOPIC DISTRIBUTION



Source: Macrobond and Nordea

With new minutes, we are more interested in comparing how the discussions have changed compared with the previous meeting minutes. From March to May, we did not observe any major changes in the topic distributions.

COMPARING TWO SETS OF MINUTES



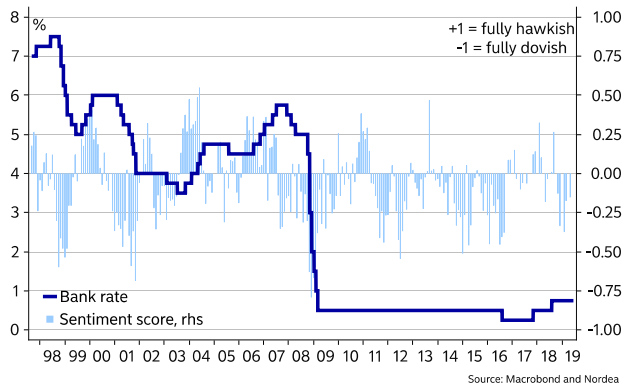
Source: Macrobond and Nordea

Measuring sentiment

MPC actions match the tone of the minutes

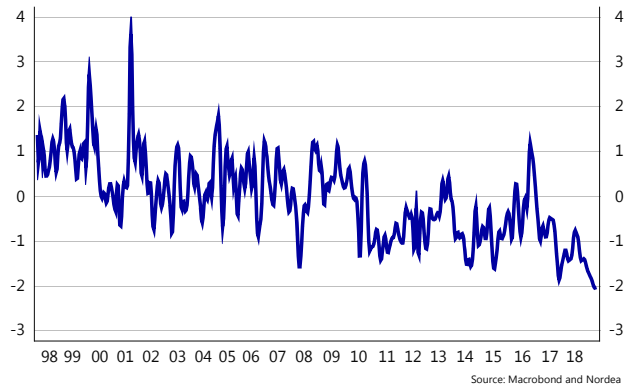
The chart below to the left shows that the sentiment score tracks rate changes quite well, especially in the period before the 2008 financial crisis. The tone of the MPC minutes indeed turns more dovish ahead of rate cuts and more hawkish ahead of rate hikes. The signals after the crisis, during the long period without rate changes, alternate from dovish to hawkish, but are predominantly dovish. The latest reading, for the May meeting, was modestly dovish.

SENTIMENT SCORE



Source: Macrobond and Nordea

UNCERTAINTY INDEX



Source: Macrobond and Nordea

Uncertainty over central bank policymaking

Uncertain times are reflected in the MPC discussions

Increased uncertainty makes the appropriate policy action harder to decide and prone to more frequent changes. We use word mover's distance (WMD) to act as an uncertainty index and to assign a value to the change in economic and financial conditions, measured as the change in the text between two sets of minutes. Higher values indicate greater uncertainty.

We see that the greatest change took place after 9/11 in 2001, since when a downward trend has been seen. However, we note an increase during the financial crisis around 2008 and at the time of the referendum to leave the European Union in 2016.

Introducing the Brexit-o-Meter

With Brexit comes great uncertainty for the central bank, so we have built a complement to the sentiment score, focusing on the discussion around the UK's withdrawal from the European Union. We hereby present the Brexit-o-Meter.

A way to measure the Brexit uncertainty

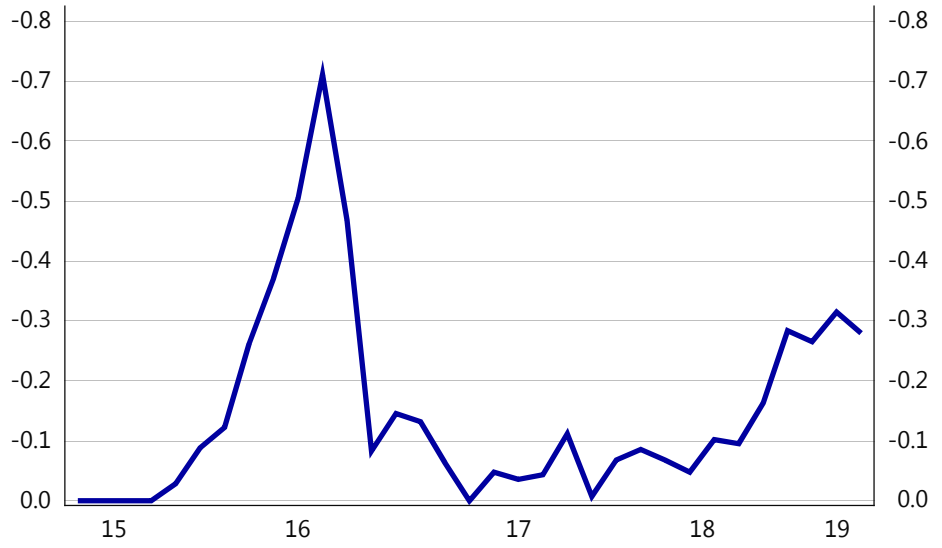
We use a simple approach of word counts, weighted by the number of paragraphs in the minutes devoted to Brexit discussions. The Brexit-o-Meter will vary between 0 and -1, with lower values indicating greater uncertainty.

We see that uncertainty peaked around the time of the referendum, with the peak value in the minutes of the meeting in July, after the vote. Then, in 2018 we see that uncertainty picked up again, peaking at the March meeting which was just before the original Brexit deadline. When digging into the March minutes, we also see that special surveys about Brexit's effect on corporate activity were included.

What does the future hold?

In the minutes in the run-up to the new 31 October deadline, we expect to see a similar pattern with the Brexit-o-Meter increasing again – especially since the risk of the Brexiteer Boris Johnson becoming the new Prime Minister is high. Read more about our Brexit house view here.

THE BREXIT-O-METER



Source: Macrobond and Nordea

We observe the greatest uncertainty around the time of the referendum – now we are seeing an increase again

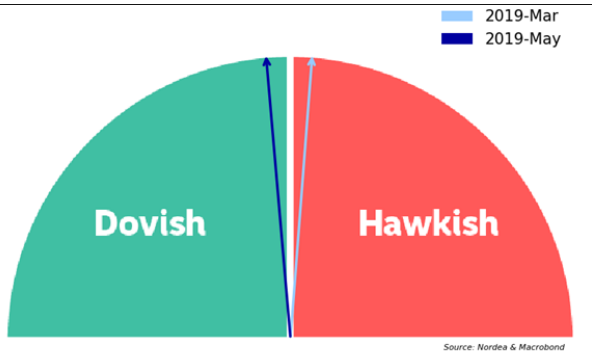
The Hawk-o-Meter: BoE on "Brexit hold"

The perennial question for central bank watchers has long been whether it will hike rates, cut rates or keep them on hold. For anyone doubting their own interpretation, we find that the AI model can quickly and reliably provide a second opinion. The model indicates that the BoE will be on "Brexit hold" for a while.

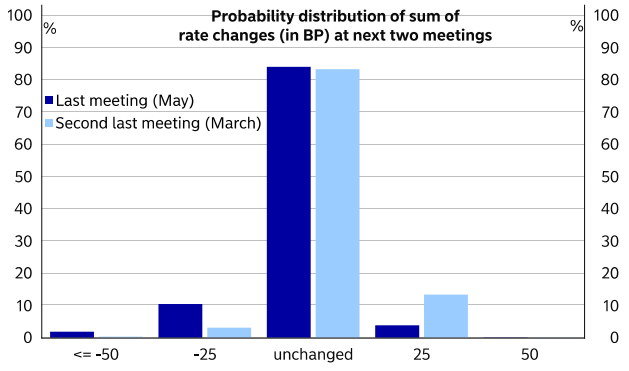
In this section, we detail how our Hawk-o-Meter can be used for financial market participants. Interested readers can find an extensive description of how our Hawk-o-Meter is constructed in the technical appendix.

The "Thermostat" Hawk-o-Meter indicates the most likely next course of action after a specific central bank meeting, and compares that with the most likely rate outcome from the previous meeting. In other words, it provides a prediction that is the weighted average of the potential rate changes and their respective probabilities. In that way, the prediction can be compared with the rate change implied by a three-month future.

"THERMOSTAT" HAWK-O-METER



PREDICTION OF THE HAWK-O-METER



Source: Macrobond and Nordea

The Hawk-o-Meter indicates that the BoE will keep rates on hold

When comparing the minutes from March to May, the change in the "Thermostat" Hawk-o-Meter is relatively small. At the same time, the probabilities of unchanged rates were high at 83-84% (much higher than for the Fed and the Riksbank at the time). In our view, this can be attributed to the uncertain outlook for Brexit. Thus, the BoE has had its hands tied for more than half a year; the signals from the labour market and wage growth in particular would, in our opinion, have led to a more hawkish tone were it not for Brexit.

The May meeting was followed up by a dovish reaction

Despite the small changes from March to May, there are still some interesting conclusions. First, the Hawk-o-Meter indicates that the minutes were more dovish in May. This may seem somewhat counterintuitive given that 29 March was the deadline at the time and thereby the risk of "no deal" was looming. However, the March minutes were, in fact, more upbeat on growth compared with February, as several indicators suggested a less gloomy outlook for Q1 than earlier anticipated.

On the contrary, the May minutes, which were also linked to the quarterly inflation report, revealed a clear downward revision of the inflation projection. In our view, it seemed as though the BoE was no longer backing the case for a stronger sterling. This view was supported by the market reaction, whereby the EUR/GBP strengthened and the front end of the curve, especially, was dovishly repriced.

The Hawk-o-Meter does a decent job of predicting rate changes

Looking back at the Hawk-o-Meter's performance over the past few years, there are also some interesting things to note. Thus, the most dovish score was printed at the MPC meeting leading up to the 2016 Brexit referendum, whereas the two most hawkish scores were at the two meetings preceding the two most recent rate hikes (November 2017 and August 2018). Furthermore, the lowest score since 2016 was in December last year, when the MPC clearly stressed downside risks to growth due to Brexit.

The "timing" Hawk-o-Meter is currently in line with our view on the BoE

As such, it appears that the Hawk-o-Meter does a decent job of predicting both upcoming rate changes and whether the MPC thinks the risk picture has changed. The "timing Hawk-o-Meter", currently showing that the BoE will keep rates on hold, also fits well with our current view. Thus, we do not buy into the recent relatively hawkish comments from Carney, Haldane and Saunders in June with so much Brexit uncertainty still around. It will, however, be interesting to see if the latest hawkish messages are actually filtered through in the Hawk-o-Meter for the June meeting.

Technical appendix

The techniques used in this report are various forms of natural language processing (NLP), which we explained in further detail in our earlier report.

Text sources

To identify the topics discussed in the text, we use monetary policy minutes from the Bank of England web page dating from September 1997 to May 2019, and apply a latent Dirichlet allocation (LDA) model.

Identifying the topics in the meeting minutes

LDA is a common approach to topic modelling, first developed by Blei et al in 2003. The model assumes that a document (or minutes) is generated by some latent (hidden) topics, where each topic in turn is a latent distribution over words. The purpose of the algorithm is to find these two distributions which we can then use to explain a new document (or new minutes).

Sentiment analysis – more dovish or hawkish?

The tone in the minutes is measured as a degree of hawkishness or dovishness by means of a simple word count. Two lists of hawkish and dovish words are manually constructed. Examples of hawkish words are "increase", "raise", "growing" and "tightening". Dovish words include "decreasing", "lower", "uncertainty" and "weaker", to mention just a few.

The words in the minutes are counted and stored as dovish and hawkish scores, which are then aggregated to a sentiment score, ranging between -1 and +1, with higher values indicating a more hawkish tone.

We hereby present the Brexit-o-Meter!

Similar to the sentiment score, we use word counts to capture uncertainty in the discussions, specifically in the paragraphs dealing with Brexit. This time, we use different lists with positive and negative words. Some examples of negative words are "uncertainty", "risk" and "depreciation", while some of the positive words are "strength", "higher", "rise", etc.

After counting all of the negative and positive words and aggregating them to a sentiment score, the next step is to weight the score by the number of paragraphs in the minutes devoted to Brexit, as longer discussions could be an indicator of greater uncertainty. The resulting Brexit-o-Meter will range in values from 0 to -1, with lower values indicating greater uncertainty.

The Hawk-o-Meter: raise, cut or stay still?

Our Hawk-o-Meter is a word count based on the LDA model. The topic model allows us to filter paragraphs related to different topics, and is thus able to separate the meaning of the word "high" when discussing, for example, oil prices or unemployment, two topics for which the word carries different implications. We use a "window" based on the realised change in the bank rate over the upcoming two meetings, where words appearing frequently ahead of rate hikes are assigned a positive weight and words used more frequently before cuts are assigned a negative weight. Words appearing in the window with no rate change are assigned a weight of zero. We can then use these weights on new minutes to assess the probability of the direction of the rate.

Taking this one step further, we use a probit model, which scales our probability into predicting a rate change in basis points.

Our measure of uncertainty - word mover's distance

To measure how the content in the minutes has changed from one meeting to the next, we use the word mover's distance (WMD) developed by Krusner et al (2015). The model is based on word2vec, which creates vector representations of words and maps similar words close together. The WMD is then the "distance" all words in one document needs to "travel" in order to reach the other document.

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