BANK OF ENGLAND

Speech

An end-of-year retrospective on the UK outlook and monetary policy

Speech given by
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1. The season of giving…a retrospective

Good morning everyone and thank you for having me here today. I am delighted to be at the Resolution Foundation, whose work on the living standards of low to middle-income citizens is both directed at a key question and thoroughly done; and whose influential status is thereby so richly deserved.

Christmas time is officially upon us and, with that, the usual feeling of wanting to make sense of the year gone by. It is such a tempting desire that not even an MPC member can resist. For me, it is even more so, given this has been the first year in my new job.

Furthermore, I have an extra motivation for a review, since I voted to cut Bank rate at the November and December meetings of the MPC and I therefore wanted to set out my reasons for doing so.

You will forgive me then, if I take this opportunity today for a general retrospective on the past, present and future of the UK economy, in particular:

- Economic activities in the UK weakened during the last year. When I joined the Bank in September 2018, a strong outlook for the world was supporting UK growth. Along with a tight labour market, domestic wage and price pressures would have sustained UK inflation around target. This is unfortunately no longer the case: Brexit uncertainties have persisted, trade wars have slowed world momentum and a margin of excess supply has re-emerged. Thus, if a Bank Rate of 0.75% and a limited and gradual tightening over the future seemed the correct stance for monetary policy when I joined the Committee last year, I now judge a lower rate and a more protracted period of looser monetary policy to be more appropriate.

- I am of the view that further downside risks are lingering over our forecast in the latest MPR. Uncertainty could remain entrenched as the process of UK-EU trade negotiations unfolds; the labour market may slow down causing a longer and deeper reopening of excess supply; as a result, domestic costs pressures may not pick up and inflation may not bounce back from its near-term weakness.

- These risks are more concerning as the UK economy is near the effective lower bound for interest rates (ELB). There is a case to be made for a monetary policy-maker to buy some *insurance* against falling to the ELB, as central banks are better equipped to combat above-target inflation than below-target inflation when interest rates are close to the ELB.

This is why I voted for a cut back in November and, given economic data have been broadly in line with the November forecast since then, I maintained this stance in December.

Let me walk you through each point in turn.

2. The ghosts of forecasts past

Many pieces of evidence suggests that the UK economy is weaker than a year ago.

Chart 1: August 2018 Inflation Report annual GDP growth fan chart against latest outturns

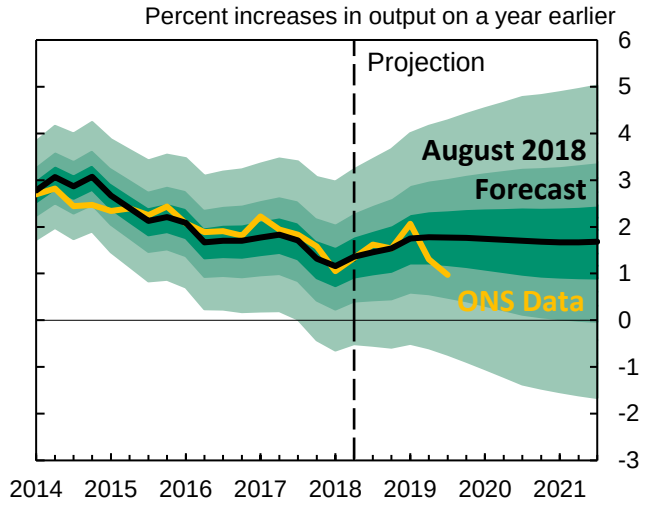
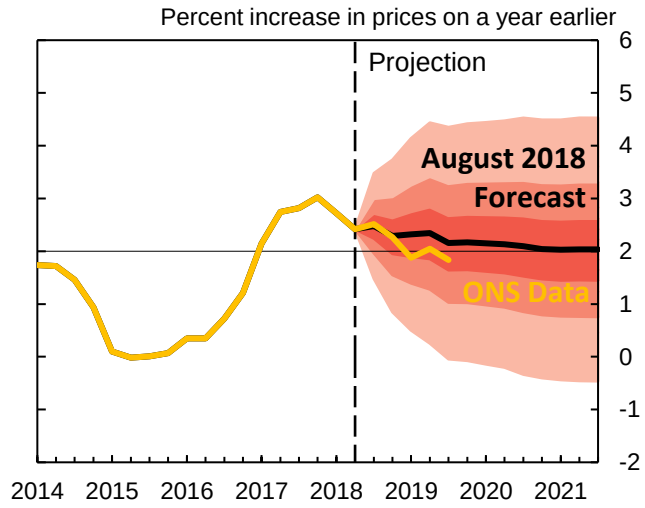


Chart 2: August 2018 Inflation Report annual CPI inflation fan chart against latest outturns



Source: August 2018 Inflation Report and ONS.
Note: The fan chart is constructed so that outturns are expected to lie within each pair of the lighter shaded areas on 30 out of 100 occasions. In any particular quarter of the forecast period, the outturn is therefore expected to lie somewhere within the fan on 90 out of 100 occasions.

In August 2018, just before I joined the MPC, the Bank of England published its regular Inflation Report[1], now rebranded as the Monetary Policy Report[2]. As set out in **chart 1** the MPC, conditional on a gently rising path of Bank rate implied by market yields at the time, expected GDP to grow by an average of around 1¾% per year over the forecast period. This was slightly above the UK's estimated potential rate of growth. Global demand was also projected to grow above its estimated potential rate over the forecast and financial conditions remained accommodative at the time. CPI inflation was 2.4% in June 2018 and expected to gently decline towards target (**chart 2**). The MPC expected domestic costs to push up on inflation as external cost pressures from the effects of sterling's previous depreciation and higher energy prices waned. In order to achieve inflation at target by the end of the third year, this warranted an increase in Bank rate to 0.75% and a gently rising path for it over the forecast horizon as implied by market yields at the time.

When I joined the MPC in September 2018, I agreed with this view. I have also agreed over the last year with the decision of maintaining the Bank rate at 0.75% with a view to a 'limited and gradual' tightening over the next years, so as to minimise the possible disruption from removing stimulus too quickly after a decade of very accommodative credit conditions.

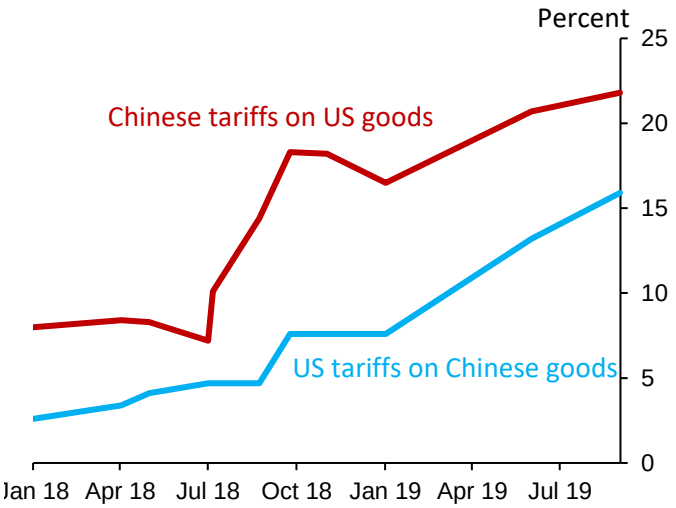
However, over this same period the actual outturns for both GDP growth and CPI inflation have been disappointing, as shown by the yellow lines in **chart 1** and **2**. UK GDP growth has slowed materially this year

[1] See for more details the Bank's August 2018 Inflation Report.
[2] See for more details the Bank's November 2019 Monetary Policy Report.

and inflation has fallen. This is due, in my view, to weaker global growth, driven by trade tensions, and the domestic impact of Brexit-related uncertainties. Let me expand on this.

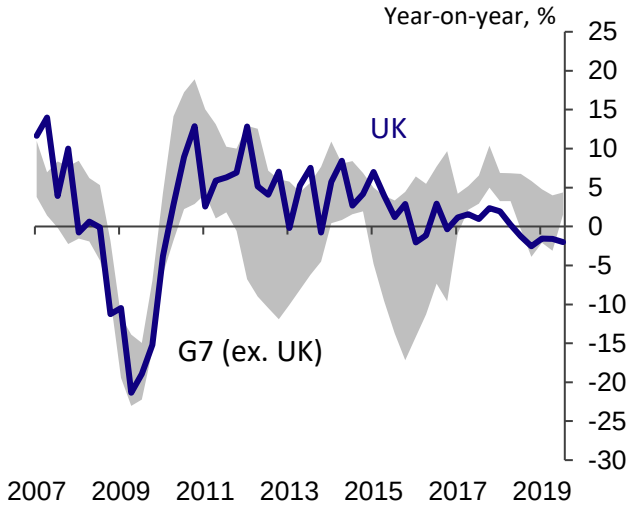
First, the world. The global economic outlook has weakened materially since 2018, turning gloomier and less supportive of UK growth. This was mainly the result of heightened uncertainty combined with a slower pace of recovery in the Euro Area and, in particular, the escalation of US-China trade tensions. **Chart 3** shows just one indicator of trade tensions, namely the trade-weighted average tariffs on bilateral trade between the US and China.[3] The G7 investment swathe reported in **chart 4** also shows a considerable slowdown: to the extent that investment is forward-looking, this is again indicative of cooling sentiment.

Chart 3: Weighted average tariff rates



Sources: Ministry of Commerce of the People's Republic of China, Office of the United States Trade Representative and Bank calculations.

Chart 4: G7 investment swathe

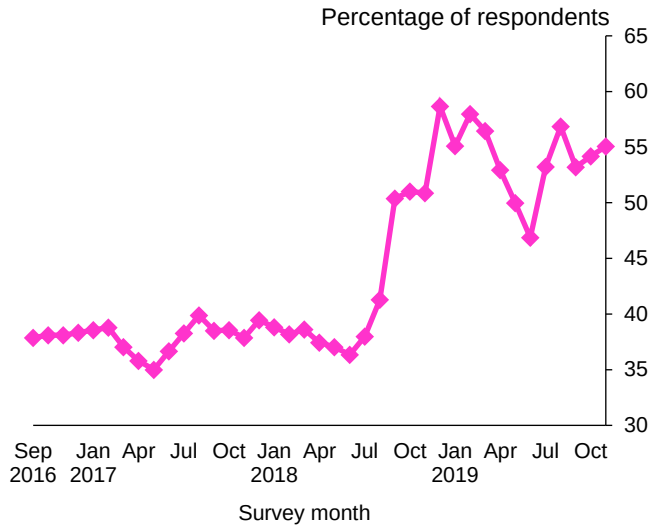


Source: OECD.

Second, turning to the domestic economy, I would like to focus on uncertainty. Higher levels of uncertainty stemming from the Brexit process—the proportion of firms that cite Brexit as an important source of uncertainty is still elevated (**chart 5**)—have weighed on the UK economy mainly through their effect on firms' investment (**chart 6**)[4] and productivity. Investment growth has been negative and we have been consistently below or near the bottom of the swathe of G7 investment growth (**chart 4**).

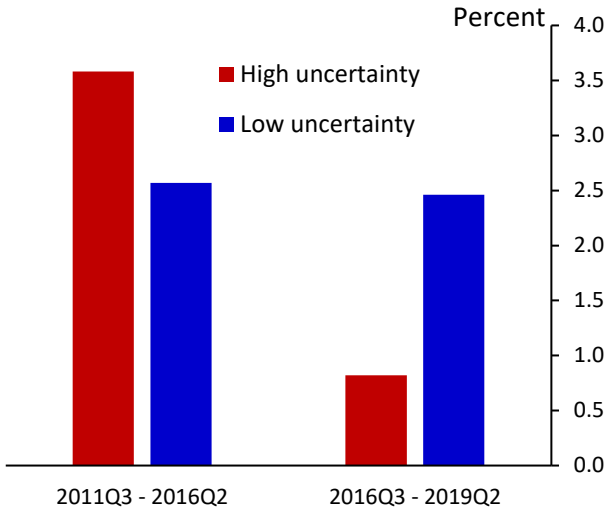
[3] As global tariffs have been falling steadily since the 90s and have been at those low rates for more than a decade now, the increase observed since mid-2018 is quite substantial. For more details, see section 3 of the Bank's November 2019 Monetary Policy Report.
[4] Chart 6 shows the following. The DMP survey started asking about Brexit uncertainty after the referendum in 2016. The chart matches past investment data from company accounts to the firms in the DMP and thereby shows the investment of firms before and after 2016 who reported Brexit uncertainty after 2016. It shows that the low investment firms after 2016 were not just firms who, before 2016, were not investing anyway: in fact, they were investing more before 2016.

Chart 5: Brexit in top three current sources of uncertainty[5]



Sources: Decision Maker Panel (DMP) Survey and Bank calculations.

Chart 6: Average annual investment growth for firms, by Brexit uncertainty[6]



Sources: Bureau van Dijk, DMP Survey and Bank calculations.

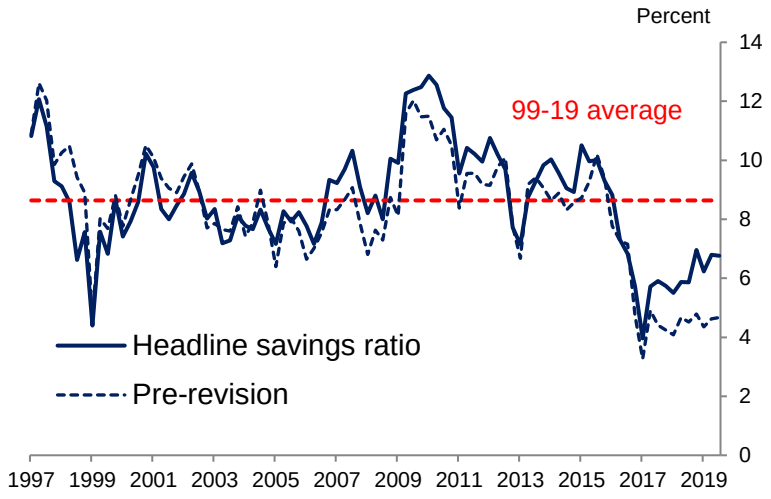
There is tentative evidence that uncertainty may have affected also households. The latest revisions to the savings rate suggest that saving has been higher and has been growing more than we had thought, putting consumers somewhat more in line with the cautious corporations. Indeed, the household saving ratio had been flat for the past two years at around 4½%, having dipped immediately after the referendum due to the squeeze on real incomes from sterling's depreciation (**chart 7**). This was the lowest recorded household saving ratio since 1963. Recent revisions alter both the level and trend in the saving ratio.[7] The latest estimates put the saving ratio in 2017 at around 5¾%, more than a percentage point higher (**chart 7**). Since then, the saving ratio appears now to have been on a steadily rising path over the past two years, reaching around 6¾% by the middle of 2019.

[5] Question: 'How much has the result of the EU referendum affected the level of uncertainty affecting your business?'. Respondents can select: 'Not important'; 'One of many sources'; 'Two or three top sources'; or 'Top source of uncertainty'. Before August 2018, data are interpolated between waves and shown as three-month rolling averages. The DMP currently consists of around 8,000 businesses with around 3,000 responses a month being received. Latest DMP survey was conducted between the 8th and 22nd of November 2019.

[6] Note: the sample uses DMP data where available (all post-referendum) and company accounts from Bureau van Dijk otherwise. See chart 5 footnote for question about Brexit as a source of uncertainty. 'High' uncertainty is defined as placing Brexit in the top three sources of uncertainty. Data are unweighted averages across firms.

[7] That was driven by revisions to mixed income (predominantly from self-employment) and, to a lesser extent, student loan interest.

Chart 7: UK savings rate

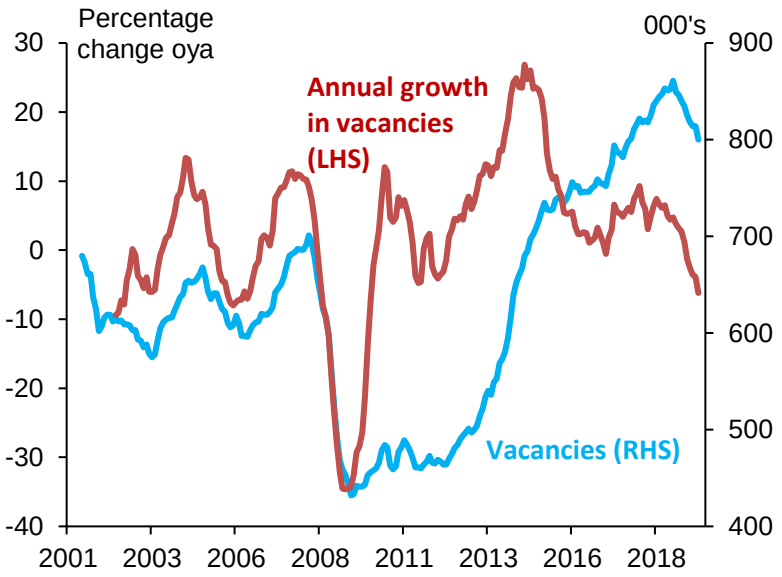


Source: ONS.

Of course, this is not enough to point to a clear switch of households towards a 'precautionary' saving behaviour. The level of the savings rate is still low by historical standards - its average over the last 20 years has been well over 8% - and will be nudged down following mixed income revisions in the Quarter 3 2019 Quarterly sector accounts.[8] Furthermore, households may have simply adjusted their consumption patterns to weaker long-term income expectations, for example following the declining house prices since early 2016. Nonetheless, I believe the weakness in consumer confidence over the last years[9] is suggestive of, at least, some of the saving rate increase to be due to precautionary motives.

Third, the output gap. Again, when I joined the output gap was in balance and demand was expected to gently outstrip supply. This is what happened over the quarters to the beginning of 2019, with stronger GDP growth (**chart 1**) occurring despite low productivity; but since then, perhaps along with world trade, the output gap started to fall. Consequently, it is now estimated to be negative: while a year ago the November 2018 Inflation Report forecast expected a positive output gap of about +¼% for 2019Q4, according to the Bank's latest forecast we actually have excess supply of around -¼% in that same quarter. This turns into excess demand only from 2021. This is the result of the re-emergence of some spare capacity within firms, while there appears to be little spare capacity in the labour market with unemployment stable around 4%. Despite this, there is increasing evidence of weakening demand for labour, as reflected by a prolonged decline in vacancies over this year (**chart 8**).

Chart 8: Number and growth of vacancies



Source: ONS.

Fourth, inflation has been steadily declining over the past year since its peak around 3% in 2017Q4, following from the fading effects of the sterling depreciation from the Brexit referendum. In less than two years, it has

[8] See this ONS article for more information on this.
[9] See for example the decline in the GfK measure of consumer confidence.

already halved, being now around 1.5% and is forecasted to be below target throughout 2020, owing to the temporary effect of falls in regulated energy and water prices. Of course, this sits in direct contradiction with the strong wage growth we have seen.

Indeed, one of the more puzzling features of the UK economy over the last years has been that wage growth has been strong, while productivity has hardly grown at all and inflation has been low. Thus, something must have been happening to firms' 'margins', or 'profits'. So what is going on? My investigation of UK firms' margins over the last years reveals a period of rising margins in 2010-14 and then falling in recent years.

Chart 9 shows this through the so-called *factor price frontier*[10]. The axes are the deviation from trend of real product wages and real capital rental rates (that is, labour and capital compensation deflated by value added deflator).[11] The points on the graphs are annual data from 1970 to 2018 de-trended by an HP filter, designed to remove any labour and capital augmenting technical change. Thus, one can think of each point as, for that year, the real labour and capital compensation the economy can support with efficiency/technology held constant. Not surprisingly then, the scatter of points is downward sloping as, for a given technology, real labour compensation can only rise if real capital compensation falls, or equivalently firms' margins are squeezed when wages are higher.

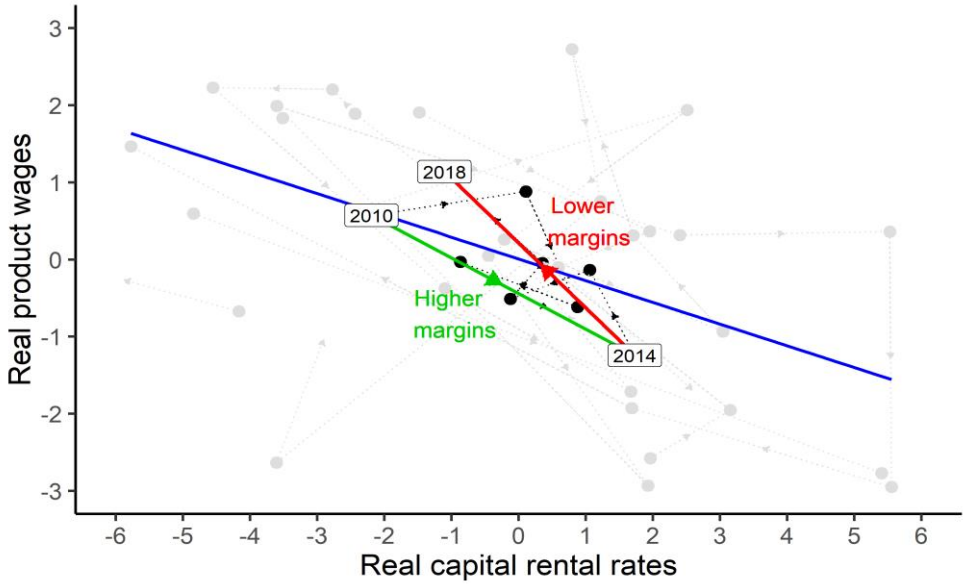
I have labelled three recent points. In 2010, following the Great Recession, we were in a period of low returns to capital and relatively higher wages. Over the next 5 years, margins were rebuilt at the expense of wages, at which point we started travelling back up the frontier to where we are today: squeezed margins leaving inflation low despite strong wage growth.

Where does the economy go next? Further movements up the frontier will lower capital returns more and raise wages. Alternatively, firms could raise prices, although it seems difficult with competition strong, or real wages might flex downwards, perhaps as unemployment opens up, eroding the bargaining position of workers, already weaker with capital mobile. Thus, I would expect the pace of wage growth to slow.

[10] See appendix for more details. The empirical analysis of the factor price frontier was introduced by Bruno and Sachs in their 1985 book, *The Economics of Worldwide Stagflation*. They pointed out that technology and raw material price shocks shifted the frontier. With improved measurement of value added raw material price shocks no longer shift the frontier.

[11] Define the capital rental rate as that rate such that in the national income identity value added exhausts labour and capital income. This can be further transformed with some more assumptions into a net rate of return on capital. That measure is, of course, related to various accounting measures such as EBITA and to statistical agency published profit rate measures, although the triangulation between these measures is not straightforward given the different conventions about what counts as capital in national accounts (for example, dwellings and differential treatment of capital assets like software and data). There is also the issue of interpretation given that some of these measures are residually determined, although that issue would arise in any cost-based method.

Chart 9: UK factor price frontier, 1971-2018
(deviation from trend)

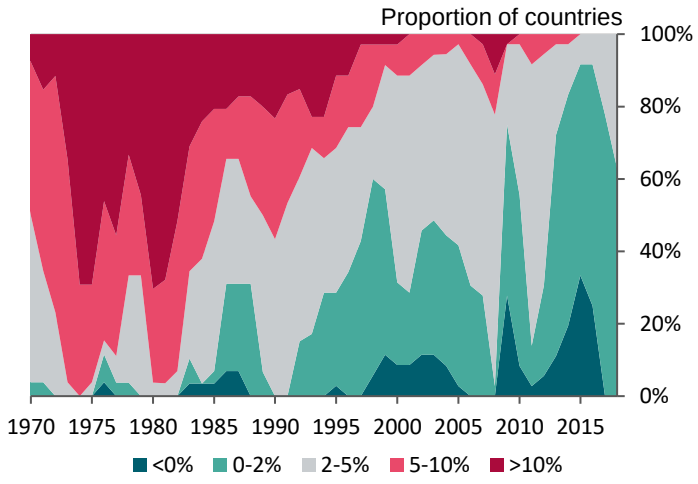


Source: ONS and author calculations.

Note: The factor price frontier is a scatter plot of the percent deviations from trend of real capital rental rates and real product wages. Series are normalised by the price of value added and de-trended using an HP filter at an annual frequency. The blue line is the linear line of best fit. The grey points and lines are for the period 1971-2009, the black are for the period 2010 to 2018.

To summarise, over the past year the MPC has had to downgrade its view on the world and the UK economy repeatedly, with the initial period of softness in the forecast now extended and deepened. This has also extended to prices: we now observe and expect further weakness in inflation. This means that the UK outlook is becoming more similar to those of other advanced economies: as showed in **chart 10**, the majority of the advanced economies are experiencing inflation below 2%.

Chart 10: Inflation across advanced economies



Source: World Bank.

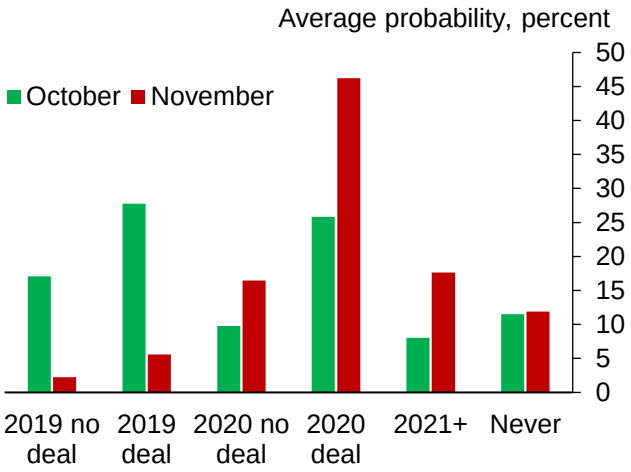
3. Risks around the present forecast

So much for how we got here. Where are we going?

The current forecast from the November 2019 Monetary Policy Report exhibits some weakness in growth and inflation in the near-term, which then retreats in favour of a bounce back to a stronger and healthier outlook for both activities and prices. It is very much a forecast of two halves. This shape for the central projection has important consequences in terms of optimal monetary policy. Central banks' flexible inflation targeting remits are often represented by quadratic preferences that penalise deviations of inflation from target and output from

potential. Applying such a set-up to the forecast, because output and inflation are so much stronger in the medium-term than in the near-term, a policymaker may seek to smooth the coming strength in demand by having it start sooner and last longer, but be smaller in any given period. This is a common result in models assuming a convex 'loss function' for the policymaker, meaning that policy-makers prefer a long sequence of small deviations to a short sequence of large deviations. Of course, this result would not hold with different preferences[12], although I just wanted to mention this to make clear that the current central case is already consistent with some degree of loosening.

Chart 11: Probabilities around EU withdrawal outcomes[13]



Sources: DMP Survey and Bank calculations.

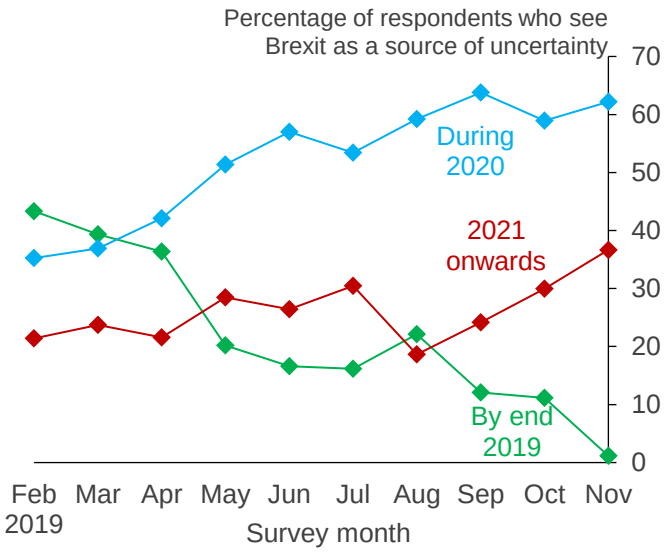
I have thus no problem in agreeing with the central projection from the MPC's latest forecast, as it already supports some near-term loosening for which I have advocated. That said, I personally place a significant amount of probability on the possibility that the path for demand and, thus, inflation may turn out lower than our central expectations.

One source of downside risk to demand is possible protracted uncertainty from Brexit. The recent election has clarified the Parliamentary arithmetic. However, we must remember that what matters are the perceptions of uncertainty in financial markets and by consumers and firms. **Chart 11** suggests that the Withdrawal Agreement and Political Declaration agreed in October between the UK and the EU seem to have reduced the perceived likelihood of a no-deal Brexit markedly among firms. The current forecast reflects this as it is conditioned on a smooth transition towards a CETA-like free trade agreement between the UK and the EU.[14] However, it normally takes quite some time to sign a trade agreement. Indeed, CETA's negotiations started in 2009[15] and the agreement has been provisionally applied only since 2017.[16]

[12] In particular, the use of a quadratic objective function does not reflect the extent to which most individuals have strong preferences for minimizing the incidence of worst-case scenarios (Mishkin, 2008). Furthermore, different views from policy-makers on the timing and strength of the monetary policy transmission mechanisms may also affect this result. For example, a policy-maker who believes that monetary policy takes many lags to have effects on the economy may decide to look through the temporary weakness in the near-term.
[13] Note: the results are based on the question 'What do you think is the percentage likelihood (probability) of the UK leaving the EU in each of the following years?
[14] We assume that goods trade is tariff free, but customs checks would take effect immediately at the end of the transition period on 31 December 2020. In contrast, some regulatory barriers to trade are likely to emerge only gradually, for example as goods standards diverge over time. Some services trade would also be subject to greater barriers, in particular financial services. The MPC's forecast assumes that the impact of all these barriers on the economy is orderly though, as authorities and businesses are assumed to have taken action to be ready for the change in trading arrangements. Finally, the UK is assumed to replicate a substantial proportion of EU trade arrangements with non-EU countries. For more details on the MPC's conditioning assumption about the UK's eventual trading relationship with the EU, see the November 2019 Monetary Policy Report.
[15] See here for more details.
[16] See here for more details.

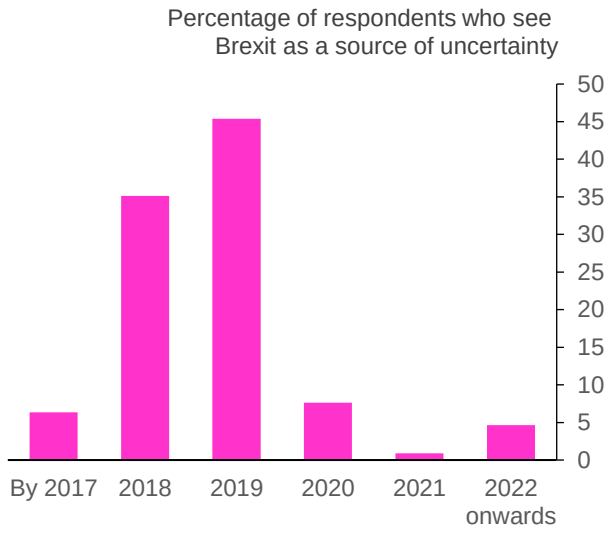
Uncertainty may thus continue to stay entrenched for some time as the details of the negotiated provisions and what they mean for UK businesses and households will become clearer only at a later stage as our final destination emerges. I find it helpful to remember that Brexit is a process, not an event.[17]

Chart 12: When is Brexit uncertainty expected to be resolved?[18]



Sources: DMP Survey and Bank calculations.

Chart 13: Expectations of when Brexit uncertainty will be resolved in June 2016[19]



Sources: DMP Survey and Bank calculations.

Businesses seem to share this view according to the latest results from the Decision Maker Panel survey run in November.[20] Just under 40% expected their uncertainty to persist until at least 2021, with this proportion having increased on the month and doubled since August (**chart 12**). The trend of Brexit-related uncertainty taking longer to resolve than previously expected is also evident if we ask firms about when they expected Brexit uncertainty to be resolved shortly after the referendum. **Chart 13** indeed shows that, in June 2016, 87% of firms expected Brexit-related uncertainty to have been resolved before the end of 2019, while only 13% of firms expected their Brexit-related uncertainty to persist further into 2020 or later.

As I have already mentioned, I also note re-emergence of excess supply in the economy. In particular, I fear that this may be the first sign of a new and protracted slowdown. While it is true that the unemployment rate is very low, at around 4%, and indicative of a tight labour market, it is also true that this is a somewhat backward-looking measure. In contrast, if we consider indicators such as vacancies posted by companies which are more forward-looking given the time it takes to hire (skilled workers at least), we discover that they have undergone a dramatic drop over the last year (**chart 8**). Therefore, you will not find it so surprising that I am worried that this may be signalling a forthcoming slowdown in UK employment.

[17] For more discussion, see Haskel (2018).
[18] Note: the results are based on the question 'When do you think it is most likely that the Brexit-related uncertainty facing your business will be resolved?'
[19] Note: the results are based on the question 'Thinking back shortly after the Brexit referendum in June 2016, at that point when did you expect it was most likely that the Brexit-related uncertainty facing your business would have been resolved?'
[20] Notice the Brexit deadline was extended to 31 January 2020 before the November survey opened.

Another possible risk around the projections is the possible smaller effects from looser monetary policy over the past years, which would implicitly mean that the current stance is more contractionary than we have previously thought. For example, the equilibrium interest rate for the UK may have gone down by more than expected in the last years, e.g. because of the negative effects of Brexit on UK structural productivity.[21] Similarly, heightened uncertainty may have weakened the transmission mechanisms from Bank rate cuts. For example, Bunn, Le Roux, Reinold and Surico (2018) find that (controlling for balance sheet factors) households who are more uncertain report cutting spending by more in the face of negative income shocks, and perhaps increase by slightly less following a positive income shocks, as would be the case under a cut.[22]

4. Insuring against the ghosts of low inflation future

In my view, the current data and weak near term forecast is enough to justify a cut. I would like to discuss another reason for cutting now, namely *risk management*.[23] What does this mean?

Risk management arguments propose that the possibility of running out of monetary headroom, e.g. by being close to the Effective Lower Bound (ELB), warrants looser monetary policy in advance of it occurring (e.g. Evans et al (2015) and Adam and Billi (2007)). The idea is that an interest rate cut is a kind of *insurance policy*, taken out to stop growth and inflation from slowing down so much that the central banks would have nothing to do but drive the interest rate to its lower bound.[24]

Notice we would not need this insurance if a central bank's toolkit contained alternative instruments that were perfect substitutes for changing the policy rate. In those cases, the ELB never binds and thus is never a problem. In the real world however, the effects on the economy of unconventional policies such as QE are much more uncertain than those of traditional tools. There are divergent empirical estimates of their effects, and there is uncertainty about the theoretical mechanism behind those effects.

The conclusion from risk management is general, as it does not rely significantly on model specifications. For example, it holds across several assumptions on the expectations formation of the different agents in the economy.

If agents are forward looking, looser policy through risk management of monetary policy offsets the disinflationary effect that an expectation of reaching monetary policy limits could have. This mechanism operates through the so-called expectations channel, which arises because the possibility of a binding ELB

[21] See for more details Bank of England August 2018 Inflation Report.
[22] Of course, when I argue that our monetary policy stance may be more contractionary, I am considering the cuts since the financial crisis in 2008 as well as possible future cuts. I note this, as the last two changes in Bank rate have been hikes.
[23] Other policy-makers before me have mentioned this as a justification for a looser stance for monetary policy, e.g. Mishkin (2008) and, more recently, Fed's Chairman Powel (2018b) and Chicago Fed President Evans (2019).
[24] To be precise, as observed by Greenspan (2004) and Mishkin (2008), the risk management argument may refer to any asymmetries in the outlook, not necessarily from the ELB. Thus, technically the risks that I have described in section 3 are already enough by themselves to warrant a looser path for policy than the one implied by the central forecast. For more on optimal monetary policy, risk and the ZLB, see for example recent Staff work by Seneca (2016).

tomorrow leads to lower expected inflation[25] and output today and hence dictates some counteracting policy easing today.

In contrast, if agents are backward looking, looser policy increases momentum, reducing the chance of reaching constraints on policy. This works through the so-called buffer stock channel, which occurs because, if inflation or output is intrinsically persistent, building up output or inflation today reduces the likelihood and severity of hitting the ELB tomorrow.

Naturally, as in every insurance contract, we must ask ourselves 'is it worth it?' Of course, the answer depends on: (i) how likely we think the bad outcome is, and (ii) the premium we pay for the insurance.

This first item leads us to the question of whether policy-makers might overstate the probabilities of meeting the ELB, which takes one to a broader discussion of the behavioural economics of decision-making, which I leave to another time. Here I merely note that, as I have described above, I believe there is a substantial chance of inflation being quite weak and for growth to slow down more in the near-term.

On the second, I think in this context the insurance might be quite cheap. Even if it turns out that the policy-maker has overstated the probability of ending up at the ELB, we can undo the stimulus by raising interest rates, given the much larger policy space we have available in terms of tighter policy. In this sense, I believe the costs of reversing policy would be quite low as expectations are unlikely to be de-anchored from looser monetary policy after so many years of 'lower for longer'.[26]

4. Conclusion

In this speech, I have tried to give you my personal assessment on where the UK economy is heading and, in particular, explain why I voted for a cut in November and December:

- The economic outlook for the UK has weakened during the last year: Brexit uncertainties have weighed on the economy and the world's economic outlook has deteriorated. Inflation is low and projected to stay low. Thus, I believe current data justifies looser monetary policy.

- Looking forward, I believe that downside risks are lingering over our forecast. In particular, Brexit uncertainties may remain entrenched. Brexit is a process not an event.

[25] Indeed, many measures of UK inflation compensation based on financial markets, generally considered quite forward looking, have declined in the last months. However, Haberis et al (2019) showed that external forecasts for the distribution of UK inflation were inconsistent with policy having been perceived as constrained since the crisis. Of course, confounding factors such as Brexit may have played a role here.

[26] Of course, there may be costs other than the ones related to reversals of monetary policy. For example, not tightening to control excess demand may risk the 'revenge of the Phillips curve' (Erceg et al, 2018) and financial instability (e.g. Powell, 2018a). An additional risk to tolerating positive output gaps emerges if policymakers are seen to be exploiting the non-responsiveness of inflation, e.g. because of the apparently flatter Phillips curve: systematically placing a lower weight on excess demand generates the standard 'inflationary bias', even if preferences over inflation are symmetric (Nobay and Peel, 2003).

- In addition, I wish to reduce the probability of the economy of getting stuck at the effective lower bound, since it may be harder to get it out of that situation given our current monetary policy ammunition. Following a risk management argument, I favour a cut as *insurance* against this.

What would cause me to change my mind? It might be that the world economy stabilises, for example if US and China were able to conclude their trade talks in a timely and positive manner and the pace of recovery in the Euro Area improved. It might also turn out the path to our future trading relationship with the EU and others is smoother, quicker and clearer than I currently expect. If the mist and dark clouds hovering over our economic future dissipate, I would expect a revival of confidence and productive economic activity, which would all else equal return us to the path of a slow and gradual rise in the Bank rate over the forecast horizon, similar to the outlook when I joined the MPC in September 2018.

References

Adam, K. and Billi, R. M. (2007). Discretionary monetary policy and the zero lower bound on nominal interest rates. *Journal of Monetary Economics, Elsevier*, vol. 54(3), pages 728-752, April.

Bank of England (2018). *Inflation Report*, August 2018.

Bank of England (2019). *Monetary Policy Report*, November 2019.

Bruno, M. and Sachs, J. (1985). *The Economics of Worldwide Stagflation*. Harvard University Press.

Bunn, P., Le Roux, J., Reinold, K. and Surico, P. (2018). The consumption response to positive and negative income shocks. *Journal of Monetary Economics*, Elsevier, vol. 96(C), pages 1-15**.**

Evans, C., Fisher, J., Gourio, F. and Krane, S. (2015). Risk Management for Monetary Policy Near the Zero Lower Bound. Brookings Papers on Economic Activity, Economic Studies Program. *The Brookings Institution*, vol. 46(1) (Spring), pages 141-219.

Erceg, C., Hebden, J., Kiley, M., López-Salido, D. and Tetlow, R. (2018). Some Implications of Uncertainty and Misperception for Monetary Policy. *Finance and Economics Discussion* Series 2018-059. Washington. Board of Governors of the Federal Reserve System, August.

Evans, C. (2019). Risk Management and the Credibility of Monetary Policy. *Speech at the New York Association of Business Economists (NYABE)* Economic Luncheon in New York, NY.

Greenspan, A. (2004). Risk and Uncertainty in Monetary Policy. *Remarks at the Meetings of the American Economic Association*, San Diego, California.

Haberis, A., Masolo, R. M. and Reinold, K. (2019). Deflation Probability and the Scope for Monetary Loosening in the United Kingdom. *International Journal of Central Banking, International Journal of Central Banking*, vol. 15(1), pages 233-277, March.

Haskel, J. (2018). Will UK investment bounce back?. *Speech at University of Birmingham*.

Mishkin, F. S. (2008). Monetary Policy Flexibility, Risk Management, and Financial Disruptions. *Speech at the Federal Reserve Bank of New York*, New York, New York.

Nobay, A. and Peel, D. (2003). Optimal Discretionary Monetary Policy in a Model of Asymmetric Central Bank Preferences. *The Economic Journal*, 113(489), 657-665.

ONS (2019). A review of households' mixed income estimates and plans for upcoming improvements. December 2019.

Powell, J. H. (2018a). Monetary Policy at a Time of Uncertainty and Tight Labor Markets. Speech at "Price and Wage-Setting in Advanced Economies," an *ECB Forum on Central Banking*, Sintra, Portugal.

Powell, J. H. (2018b). Monetary Policy and Risk Management at a Time of Low Inflation and Low Unemployment. Speech at the "Revolution or Evolution? Reexamining Economic Paradigms*" 60th Annual Meeting of the National Association for Business Economics, Boston*, Massachusetts.

Seneca, M. (2016). Risk shocks close to the zero lower bound. *Bank of England working papers 606*, Bank of England.

Appendix

The factor price frontier

The following national income relation holds as an identity:

$$P_v V = WL + P_k K + \pi \quad (1)$$

Where P_V and V are the price and volume of value added: W and L are the price and volume of labour services. P_K is the rental cost of capital services, K and π are 'abnormal' profits. Thus in principal we can think of firms as potentially renting capital goods in a competitive rental market, and then earning abnormal profits π over and above those costs in an imperfect product market. From this identity, we can decompose the log difference of the price of value added dp_v as follows:

$$dp_v + dv = \sigma_L(dl + dw) + \sigma_K(dp_k + dk) + \sigma_\pi d\pi \quad (2)$$

$$dp_v = \sigma_L dw + \sigma_K dp_K + \sigma_\pi d\pi - \underbrace{\{dv - \sigma_k dk - \sigma_L dl\}}_{\sigma-weighted\ mfp} \quad (3)$$

$$\sigma_L + \sigma_K + \sigma_\pi = 1$$

Where σ are the factor shares of labour, capital and profits and mfp is multifactor productivity growth (and lower case letters denote natural logs). Setting aside for the moment the issue of abnormal profits and other measurement issues surrounding the labour share (mixed income) i.e. either subsuming π into the capital share and/or assuming $\sigma_\pi \sim 0$, we can re-write (3) as:

$$dp_v = s_L dw + s_K \widetilde{dp_K} - d\,\widetilde{mfp} \quad (4)$$

$$s_L + s_K = 1$$

$$0 = s_L(dw - dp_v) + s_K\,(\widetilde{dp_K - dp_v}) - d\,\widetilde{mfp} \quad (5)$$

The price of value added has therefore been decomposed into changes in share-weighted wages and returns to capital minus measured multifactor productivity growth (which uses as a weight on capital $1 - s_L$). Note these shares are the measured shares from national accounts where s_L is share of national income going to compensation of employees and the self-employed. Equation 5 tells us that, controlling for productivity, increases in the share weighted relative price of labour must be offset with falls in the share weighted relative price of capital. This relationship is illustrated in **chart 9** (**panel A**) where productivity growth has been controlled for (roughly) by de-trending real labour and capital prices using a simple Hodrick-Prescott filter.