



BANK OF ENGLAND

Speech

Uncertainty about Uncertainty

Speech given by

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Uncertainty is the modern equivalent of a “whipping boy” for economics. A whipping boy was an official court position in the Tudor and Stuart monarchies. The boy was punished when the crown prince misbehaved, even if the boy played no role in the prince’s transgression. Similarly today, “uncertainty” is often blamed for any expected weakness in company earnings or broader economic growth - especially uncertainty around the UK’s relationship with the European Union. For example, about one-third of profit warnings by UK companies in Q3 mentioned uncertainty around Brexit and sterling.¹ The BoE’s agents cited uncertainty about the demand outlook and future trade arrangements as the biggest drag on investment intentions in their November update.² Even the MPC minutes have recently set a record of averaging 15 mentions of uncertainty each meeting, up sharply from averaging less than 6 times per meeting since the Committee was created.³

Despite this heightened discussion about uncertainty, UK economic performance has been solid. Quarterly economic growth has picked up from 0.4% in Q1, to an average of 0.6% for Q2 and Q3. This is well above the consensus expectation by economic forecasters, as well as the MPC forecast. In fact, average GDP growth over the quarters of heightened uncertainty directly before and after the UK referendum on EU membership has been stronger than for all of 2015. It has even been above what is generally believed to be the UK’s potential growth rate. This raises obvious questions. Are we overestimating the negative economic effects of uncertainty? Is the ease of blaming the “whipping boy” of uncertainty causing us to miss important underlying dynamics in the UK economy?

Just as the whipping boy of the 15th and 16th centuries was not always irrelevant to his punishment, however, UK earnings and the broader economy are not unaffected by the uncertainty at hand. The whipping boy was not a poor, innocent, unrelated street urchin. He was a well-born and titled friend of the crown prince. His close relationship with the prince meant that the royal would (hopefully) be less likely to misbehave so that his friend was not whipped. As a confidant of the prince, the whipping boy could also play a role in encouraging proper behaviour. Similarly, uncertainty around the UK’s future relationship with the European Union has undoubtedly had some impact on companies’ investment plans and the aggregate economy – and will continue to do so in the future. But the key question is: how much?

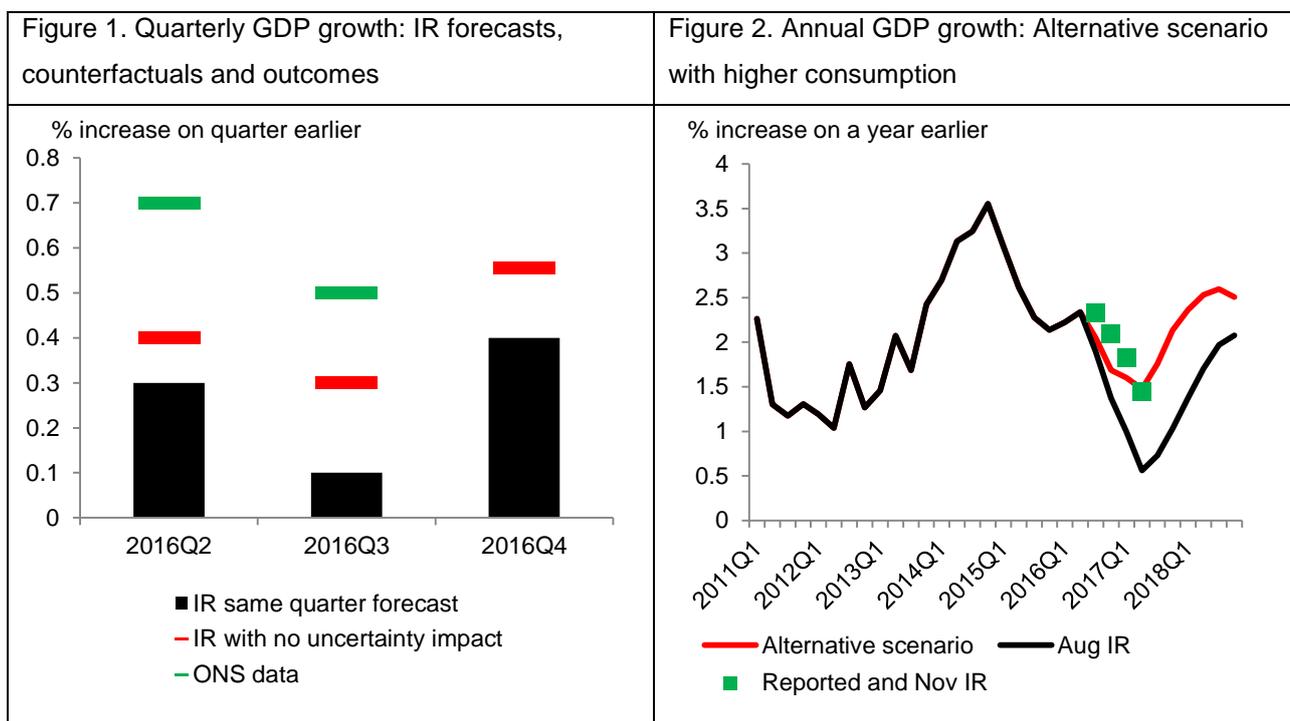
Figure 1 captures this challenge. The black shaded bars show the MPC’s best collective forecasts for economic growth in Q2 and Q3 of 2016 from the *Inflation Report* half-way through the relevant quarter. More specifically, the bar for 2016 Q2 shows the growth forecast for Q2 as made in May, and the bar for 2016 Q3 shows the forecast made in August. The green lines show the actual rate of GDP growth (based on the most

¹ EY, Analysis of profit warnings issued by UK quoted companies (available at [http://www.ey.com/Publication/vwLUAssets/ey-uk-profit-warnings-q3-2016/\\$FILE/ey-uk-profit-warnings-q3-2016.pdf](http://www.ey.com/Publication/vwLUAssets/ey-uk-profit-warnings-q3-2016/$FILE/ey-uk-profit-warnings-q3-2016.pdf))

² *Agents’ Summary of Business Conditions*, November 2016 Update, Bank of England.

³ This record was set over the six MPC meetings before November 2016. This does not adjust for changes in the length of the minutes over time. MPC minutes were substantially longer from 1997 through 2004, during which they averaged 8131 words per each Minutes. Since 2005, the Minutes have averaged only 4034 words, although the length has been increasing gradually to 5382 words since the start of 2015. When the use of the term ‘uncertain’ (in order to capture various endings) is adjusted by the length of the minutes, it has averaged 1.1 mentions per thousand words over the duration of the MPC and has only spiked twice – to 2.7 during the global financial crisis and to 2.8 recently.

recent ONS data). In both Q2 and Q3, actual GDP growth was substantially higher than forecast (by 0.4pp). Next, the red line in each column shows an estimate of growth if the mechanical drag from uncertainty (as estimated using a separate SVAR model similar to that in Haddow *et al.*, 2013) was removed from that quarter's forecast.⁴ In each case, growth would have been expected to be higher and closer to actual GDP growth, especially after the referendum, albeit not fully explaining the gap. Although a series of well-respected academic papers provide evidence that uncertainty can drag on growth through numerous channels,⁵ this exercise suggests that mechanically removing the drag from uncertainty from our forecast would have substantially reduced our forecast errors.⁶ Of course, there are many other factors that could have spurred stronger growth than expected over this period, but overestimating the impact of uncertainty should be in the line-up of suspects.



As further evidence of how overestimating the negative impact of uncertainty could significantly bias economic forecasts, Figure 2 shows an alternate scenario for annual UK GDP growth in 2016 and 2017 that I discussed at our August MPC meeting (in red), along with the collective MPC forecast (in black). This alternate scenario was one of the reasons why I did not support as aggressive a monetary easing at that time and voted against quantitative easing. My alternate scenario made just one change to our baseline

⁴ More specifically, this estimate of the growth impact of uncertainty assumes uncertainty had stayed at its long-run average, instead of increasing, and the effects on growth follow the standard mechanical treatment and multipliers. The measure of uncertainty used in these simulations is a principal component of six measures, discussed in detail in the next section. This simulation involves combining the output of two different forecasting models and is meant to be suggestive of the potential impact of uncertainty on the forecast recently, rather than as an alternate forecast, which could have involved additional adjustments.

⁵ Some important examples include: Dixit and Pindyck (1994), Bloom (2009), Bloom *et al.* (2012), Arellano *et al.* (2012), Baker and Bloom (2013), and Christiano, Motto and Rostagno (2014).

⁶ This refers to only removing uncertainty effects as estimated in the VAR, and not any effects that may already be captured in other variables incorporated in the forecast, such as movements in financial markets.

forecast: that consumption growth was stronger and remained at the same rate as the average over the previous year.⁷ Uncertainty was still assumed to have a substantial impact on investment, and monetary policy assumed to follow the market curve, both according to the standard treatment in our forecasts. Under this alternate scenario, growth was still expected to slow, but only to a trough of 1 ½% yoy, instead of to about 0.5% as in the consensus MPC August *Inflation Report* forecast. The green squares show the MPC's most recent estimate of growth in Q3 and its published November forecast for the next three quarters. My alternate scenario with stronger consumption growth still underestimated recent growth, but by a lesser degree than in the collective forecast, and better captured the shallower slowdown that is now widely expected. This comparison highlights the sensitivity of economic forecasts to assumptions about the effects of uncertainty on consumption – even without adjusting for any reduced effect of uncertainty on investment – which is believed to be even more important.

The tradition of the whipping boy in Tudor and Stuart England came about due to belief in the Divine Right of Kings, which made it inappropriate to whip a crown prince. Economic forecasters, however, are not subject to the same protection today, including the MPC. Therefore, my goal in these comments is to question, analyse, and challenge the treatment of uncertainty in our economic forecasts. There is no doubt that uncertainty matters - but how important is it? Are we accurately capturing its effects?

In an attempt to better understand these issues, my comments will address three questions. First, how should we measure uncertainty? Second, do different measures of uncertainty affect different sectors of the economy? Finally, how will heightened uncertainty in the UK today affect the economy in the future?

The answers to these questions could have first-order importance for our forecast, and therefore the appropriate path of monetary policy. The shaded black bar on the right side of Figure 1 shows the MPC's forecast for GDP growth in Q4 (of 0.4%) from the November *Inflation Report*. The red line shows the impact of removing the mechanical drag from uncertainty from this forecast - with growth increasing to 0.6% (and assuming no other adjustments are made). If growth remains around this higher level, then unemployment is unlikely to increase significantly and there would be no meaningful slack in the economy. In this case, monetary policy may need to be tightened sooner than expected. Moreover, if there is no meaningful output gap, I would find it more difficult to look through the expected inflation overshoot to above the 2% target in three years, even if it largely resulted from sterling's recent depreciation.

But are we overestimating the impact of uncertainty? Before answering that question, it is necessary to take a step back and think about how to measure uncertainty and how it can affect the economy.

⁷ Quarterly growth in consumption was predicted to remain at 0.7% through the forecast period, which was the same average rate as over the previous 4 quarters.

I. How do you Measure Uncertainty?

Uncertainty is a concept that is easy to talk about, but hard to measure. Some types of uncertainty might affect businesses, while other types might affect consumers. Uncertainty about sterling might affect large exporters, but not smaller, domestically-focused firms. Uncertainty about mortgage costs might have a greater effect on homebuilders and young adults than the older generation. Carney (2016) highlights that uncertainty can come in many forms - such as economic uncertainty, geopolitical uncertainty, and policy uncertainty. Economists try to differentiate between model uncertainty (when an agent is uncertain about the correct model of the economy), Knightian uncertainty (when the distribution of outcomes for a variable is uncertain), and Bayesian uncertainty (when the shape of the parameter distribution is uncertain).

Critically important is differentiating between a deterioration in the expected outcome and a greater range of expected outcomes. The first is not uncertainty, just bad news. The second is uncertainty, but often hard to differentiate from the first, especially as people often become more pessimistic in the face of greater uncertainty. In the context of the recent vote on UK membership in the European Union, a “Remain” voter might believe that leaving the European Union means a lower path for economic growth. This lower forecast for growth would be a deterioration in the first moment and not necessarily an increase in uncertainty. An increase in uncertainty would be a greater range of possible outcomes for growth – the second moment – and correspond to a widening in the fan chart around the mean growth path. Although the distinction sounds obvious, it is very difficult to measure, especially in surveys where individuals have trouble distinguishing between these two concepts.

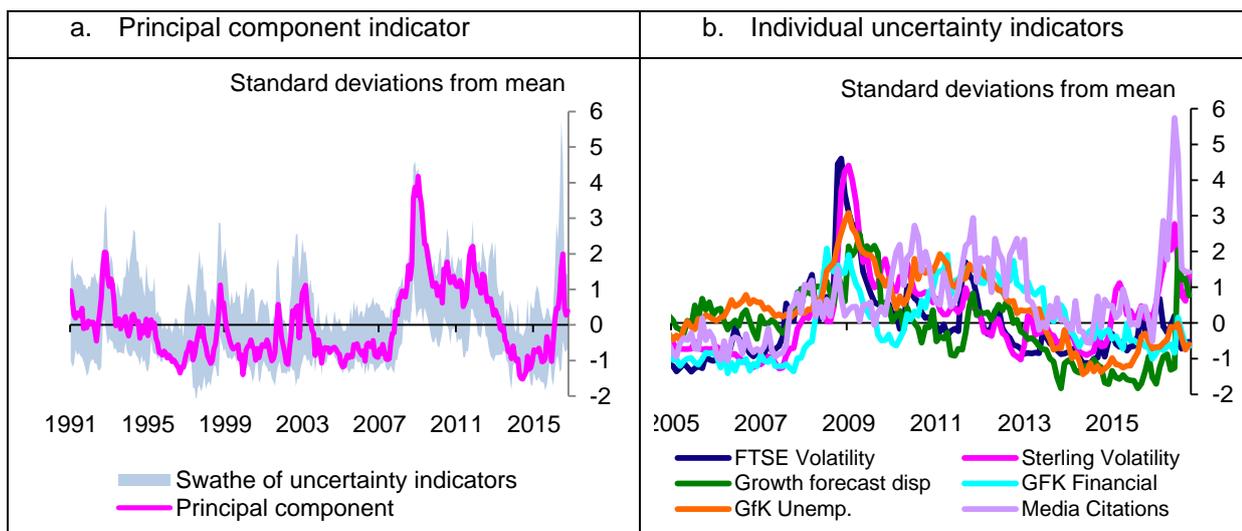
Also critically important when measuring uncertainty is capturing the various ways in which uncertainty can manifest itself. This is made more difficult as the types of uncertainty that are a concern can change over time. For example, Figure 3 shows word clouds from the MPC’s Minutes during four periods when mentions of “uncertainty” increased sharply.⁸ Words near the centre are mentioned more often, and the size of each word is scaled by its frequency. In 2002, mentions of uncertainty occurred at the same time as traditional concerns for monetary policy about higher inflation - with frequent links to words such as: price level, higher, increase, inflation, and expectations. In 2008, mentions of uncertainty occurred frequently with words such as: credit conditions, tighten, banks, and lending – highlighting concerns about the tightening of credit conditions that occurred at that time.⁹ In 2010, concerns shifted to uncertainty about the euro area and fiscal policy, with frequent use of words such as: euro area, market, government, fiscal, debt, and bond. In 2016, a new set of words stands out in the cloud linked to uncertainty: United Kingdom, leave, European Union, vote, and trade. The specific concerns during periods of heightened uncertainty have clearly changed over time.

⁸ The word clouds are formed from the words in the paragraphs where uncertainty had the greatest weight. The analysis is done over the 6-month window before uncertainty peaks in each episode.

⁹ The words linked to uncertainty changed during different periods of the crisis; for example, in other months there was more focus on sterling and in others, more focus on changes in interest rates.

Figure 4a graphs this uncertainty indicator at a monthly basis since 1991. The principal component is the solid line, and the grey swathe captures the range of the underlying measures.¹⁰ Uncertainty recently spiked upwards - from one standard deviation below its historic average in the middle of 2015 to two standard deviations above its historic average immediately after the referendum on EU membership. There are only 3 other times when uncertainty reached as high a level as after the referendum: during the 2008-9 financial crisis, during the period of heightened concern about the euro area at the end of 2011, and after the UK left the ERM and sterling was devalued in 1992. This uncertainty measure has recently declined somewhat in August and September, but increased again in October to still remain above its historic average.

Figure 4. Monthly uncertainty measures



Note: In the charts above, only six of the eight measures included in the quarterly principal component are shown. Two measures (based on the CBI survey and IBES earnings forecasts) are not shown as they are not available on a monthly basis. These two measures are currently near the middle of the swathe. See Haddow *et al.* (2013) for more information on this principal component and the underlying data.

What is driving these recent movements in uncertainty? The shaded swathe in Figure 4a shows that at least one measure of uncertainty used to form the principal component has reached a record high since the start of the series. Could changes in certain types of uncertainty have different effects on the economy than others? To better understand these dynamics, Figure 4b begins by graphing the 6 monthly measures of uncertainty used to construct the principal component. It shows that some measures of uncertainty have been relatively stable and are below their historic averages, including the measures focused on household uncertainty (based on the GfK expectations balances). Other measures, however, have increased sharply and remain well above their historic averages, especially those measuring broader economic uncertainty (media citations of uncertainty, sterling volatility, and the dispersion of GDP growth forecasts). This graph

¹⁰ The principal component discussed here and used in much of the analysis below is based on eight measures available at a quarterly frequency. In order to capture recent high-frequency movements, however, the graph in this figure shows the index calculated on a monthly basis. It uses 6 of the 8 indicators used in the quarterly measure, but does not include two data series that are only available at a quarterly frequency: the IBES dispersion of company earnings' forecasts and the CBI survey indicator. The last data on these two measures indicated that they are currently slightly above their historic averages and just below 0.5 on the graph; neither have recently spiked to the same degree as seen in some other measures.

highlights, yet again, the challenge of capturing such a multifaceted concept as uncertainty in any individual data series; different measures of uncertainty can move in starkly different directions at the same time.

Figure 5 confirms this point by showing the correlation between different quarterly measures of uncertainty. It includes the BoE principal component measure, its underlying 8 data series, and three additional popular measures of uncertainty: the Global Policy Risk Index (GPRI) from Caldara and Iacoviello (2016), Economic Policy Uncertainty (EPU) from Baker, Bloom and Davis (2016), and the VIX (a measure of implied U.S. stock market volatility). Each cell is coded by colour, with blue indicating a positive correlation, red indicating a negative correlation, and darker cells indicating stronger correlations (with either sign). The correlations across many of these measures are very low - averaging 0.36 for the full matrix. The measure of geopolitical risk stands out as having particularly low correlations with the other measures (even moving in opposite directions in some cases).

Figure 5. Correlation of selected uncertainty measures

| | BoE PC | GFK Unemp. | GFK Fin. | CBI | Earnings Growth | FTSE Vol | Sterling Vol | Growth Forecast | Media Cita- tions | GPRI | EPU |
|---------------------------------------|-----------|---------------|----------|------|--------------------|----------|-----------------|--------------------|-------------------------|------|-------|
| GFK Unemp. | 0.83 | | | | | | | | | | |
| GFK Financial | 0.54 | 0.35 | | | | | | | | | |
| CBI Uncertainty | 0.76 | 0.71 | 0.17 | | | | | | | | |
| Earnings Growth | 0.81 | 0.66 | 0.72 | 0.53 | | | | | | | |
| FTSE Volatility | 0.50 | 0.22 | 0.01 | 0.32 | 0.26 | | | | | | |
| Sterling Volatility | 0.83 | 0.60 | 0.50 | 0.58 | 0.78 | 0.68 | | | | | |
| Growth Forecast Dispersion | 0.59 | 0.57 | 0.32 | 0.37 | 0.33 | 0.24 | 0.30 | | | | |
| Media Citations | 0.56 | 0.40 | 0.14 | 0.48 | 0.54 | 0.34 | 0.45 | 0.03 | | | |
| GPRI | -0.05 | -0.01 | -0.33 | 0.09 | -0.22 | 0.08 | -0.29 | 0.05 | 0.24 | | |
| EPU | 0.47 | 0.28 | 0.55 | 0.30 | 0.51 | 0.02 | 0.36 | -0.02 | 0.89 | 0.16 | |
| VIX | 0.55 | 0.31 | 0.02 | 0.49 | 0.33 | 0.93 | 0.71 | 0.25 | 0.29 | 0.10 | -0.01 |

The BoE principal component has some of the strongest correlations - which is not surprising as it is constructed based on most of these measures. The BoE principal component is most correlated with: sterling volatility, the GFK measure of unemployment uncertainty, the dispersion of IBES earnings forecasts, and the CBI measure of business uncertainty.¹¹ This suggests that the principal component may have an advantage over other measures by better capturing various dimensions of uncertainty - including differential effects for households, companies, financial markets and the broader economy. This measure would be more likely to capture the very different forms of uncertainty captured in the word clouds in Figure 3.

¹¹ A calculation of the weightings on the different variables used to form the principal component yields a similar result; the four variables with the greatest weights are the four variables with the highest correlation with the principal component.

II. How Does Uncertainty Affect Different Segments of the Economy?

Even more important than assessing how the different forms of uncertainty move together is understanding how they move with the broader economy. For example, even if geopolitical uncertainty has little relationship with other measures of uncertainty, does it correspond more tightly to major changes in GDP growth? Are some forms of uncertainty more malignant while others benign? And do some measures of uncertainty primarily affect certain segments of the economy (such as businesses), but not others (such as households)?

Figure 6: Channels by which uncertainty can affect the economy

| Effect on: | | Evidence |
|---|---|--|
| Investment | Reduces investment and productive capacity; larger effects for more irreversible investment; larger effects on investment in housing and export sector | Dixit and Pindyck (1994); Bernanke (1983); Bond, Moessner, Mumtaz and Syed (2005); Arellano, Bai and Kehoe (2012) |
| Consumption and savings | Consumers reduce consumption and increase their buffer stock of savings; larger effects on spending for more durable and big-ticket items - especially housing; could also shift to less risky assets and therefore reduce pool of funds available for companies | Romer (1990); Carroll (1997); Benito (2006); Pistaferri (2016) |
| Productivity growth | Reduces efficient allocation of resources across economy through a number of channels: (1) less expansion by productive firms as well as less contraction in less productive firms; (2) postponing entry and exit, especially into new markets and for startups; (3) shortening of supply chains as firms attempt to guarantee inputs and shift away from foreign suppliers | Disney, Haskell and Heden (2003); Bloom (2009); Johnson and Noguera (2012); Bloom, Floetotto, Jaimovich, Saporta-Eksten and Terry (2012) |
| Labour market | Firms reduce hiring, training, and wage growth; firms may shift to more temporary and less permanent workers; workers less likely to shift jobs and less job-to-job churn; could result in lower wages and worker productivity | Lazear and Spletzer (2012); Arellano, Bai and Kehoe (2012); Broadbent (2016) |
| Financial markets and credit conditions | Greater volatility raises risk premia and cost of credit to businesses and households; banks have less incentive to provide loans to households and companies; credit conditions tighten most for startups and those without established relationships | Whaley (2000); Gilchrist, Sim and Zakrajek (2014); Alessandri and Bottero (2016) |

Before examining if different measures of uncertainty are more or less correlated with different measures of economic activity, however, it is useful to take a step back and think about how uncertainty might be expected to affect various segments of the economy. There is a voluminous literature on the various channels and relationships - a literature which I will not even attempt to survey.¹² Instead, Figure 6 provides an overview of the key channels, as well as a selection of papers providing evidence. To simplify the discussion, I've focused on five channels through which uncertainty could affect the economy and that have received at least some empirical support: on investment, consumption and savings, productivity growth, labour markets, and financial markets (including credit conditions). Although the impact of uncertainty on

¹² For recent BoE discussion of the various channels, see Broadbent (2016), Carney (2016), Weale (2016), Haddow *et al.* (2013), and the Box on Uncertainty and GDP growth in the May 2016 *Inflation Report*.

investment has received the most attention, and is believed to be the most important channel by which uncertainty influences the business cycle and broader economy, the figure highlights that uncertainty could have multifaceted effects on an economy through diverse channels.

To assess the importance of these channels for uncertainty in the UK, as well as to better assess if different measures of uncertainty primarily affect different segments of the economy, Figure 7 looks at how uncertainty measures comove with different segments of the economy.¹³ More specifically, it reports the correlations between the 12 uncertainty measures (discussed in the last section) with different measures of economic activity, roughly categorized according to the various channels in Figure 6, but grouping the housing and labour market indicators together. The cells are colour coded using the same format as in Figure 5, with red indicating a negative correlation, blue indicating a positive correlation, and darker colours indicating stronger relationships (positive or negative).

Figure 7 is a sea of different colours and shading, confirming that different measures of uncertainty seem to have different relationships with different measures of economic activity. Many of the different patterns are intuitive and support our understanding of the channels by which uncertainty works. There are, however, several points worth highlighting.

First, the correlations between most measures of uncertainty and the different economic outcomes are generally negative (red) – confirming that higher uncertainty corresponds to weaker growth, investment, consumption, productivity, housing and commercial real estate markets, labour markets, and financial markets. The few positive (blue) correlations are also intuitive – such as higher uncertainty corresponding to higher savings and higher credit spreads. Most noteworthy are the consistently positive (and often strong) correlations between uncertainty and inflation. This suggests that some of the channels by which uncertainty affects the economy could work through reducing supply, as well as reducing demand. More specifically, higher uncertainty could reduce potential growth by reducing productivity growth (directly and through lower investment) and reducing employment and labour market churn (and therefore reducing the size of the labour force through hysteresis effects and the efficient allocation of labour).¹⁴ If uncertainty only reduced demand, but not supply, then it would be expected to generate spare capacity and be associated with a fall - instead of an increase - in inflation. If uncertainty is associated with a weakening of the supply-side of the economy, this could complicate the case for monetary policy to provide support to demand during periods of heightened uncertainty.¹⁵

¹³ Correlations are reported from 1996Q1-2016 Q2 in order to include all of the measures for the full period.

¹⁴ Fernández-Villaverde *et al.* (2015) model an additional channel by which uncertainty shocks could generate higher inflation. An uncertainty shock increases the range of optimal prices firms will face in the future, and since it is more costly for the firm to set too low a price relative to its competitors (instead of too high), they choose to bias the price they choose today upward. Mumtaz and Theodoridis (2015) provide empirical evidence that uncertainty shocks can be inflationary in the US and cite a similar argument.

¹⁵ As discussed below, these variables are likely endogenous; higher uncertainty could generate higher inflation through supply-side effects, while higher inflation could generate heightened uncertainty about future real income. The effects of uncertainty on the supply-side of the economy are also likely to occur with a substantial lag, which would not be captured in these correlations. More formal analysis using a SVAR and discussed below, however, also finds that an increase in uncertainty corresponds to a reduction in measures of the supply-side.

Figure 7. Correlations between measures of uncertainty and economic activity

| Sector of Economy | Statistic | BoE Principal Component | GfK-Unemp. | GfK-Financial | CBI-Uncertainty | Earnings Growth | FTSE Volatility | Sterling Volatility | Forecast Dispersion | Media Citations | GPI | EPU | VIX | Median |
|-------------------------|----------------------|-------------------------|------------|---------------|-----------------|-----------------|-----------------|---------------------|---------------------|-----------------|-------|-------|-------|--------|
| | | | | | | | | | | | | | | |
| Aggregate | GDP | -0.63 | -0.59 | -0.53 | -0.47 | -0.54 | -0.39 | -0.54 | -0.35 | -0.21 | 0.10 | -0.20 | -0.47 | -0.47 |
| | Inflation | 0.57 | 0.65 | 0.70 | 0.45 | 0.48 | 0.09 | 0.22 | 0.39 | 0.31 | -0.33 | 0.21 | 0.15 | 0.35 |
| Investment & Exports | Capital investment | -0.27 | -0.24 | -0.11 | -0.34 | -0.14 | -0.21 | -0.29 | -0.15 | -0.03 | -0.17 | -0.04 | -0.25 | -0.19 |
| | Exports | -0.31 | -0.22 | -0.19 | -0.25 | -0.27 | -0.31 | -0.26 | -0.05 | -0.17 | 0.05 | -0.12 | -0.32 | -0.23 |
| Consumption and Savings | Consumption | -0.56 | -0.58 | -0.48 | -0.41 | -0.53 | -0.25 | -0.42 | -0.35 | -0.32 | 0.12 | -0.24 | -0.27 | -0.38 |
| | Savings rate | 0.06 | -0.13 | 0.05 | 0.19 | 0.14 | 0.06 | 0.06 | -0.03 | -0.06 | -0.28 | -0.15 | 0.16 | 0.06 |
| Productivity | Productivity/hour | -0.31 | -0.28 | -0.37 | -0.22 | -0.28 | -0.10 | -0.20 | -0.09 | -0.21 | 0.08 | -0.26 | -0.17 | -0.22 |
| | Productivity/head | -0.42 | -0.40 | -0.44 | -0.29 | -0.35 | -0.25 | -0.34 | -0.16 | -0.19 | 0.05 | -0.24 | -0.31 | -0.30 |
| Housing & Real Estate | Housing investment | -0.35 | -0.30 | -0.22 | -0.19 | -0.28 | -0.31 | -0.38 | -0.33 | -0.16 | 0.01 | -0.04 | -0.31 | -0.29 |
| | CRE prices | -0.57 | -0.46 | -0.42 | -0.37 | -0.35 | -0.57 | -0.46 | -0.36 | -0.25 | 0.11 | -0.16 | -0.64 | -0.39 |
| Labour | House prices | -0.56 | -0.52 | -0.68 | -0.24 | -0.55 | -0.20 | -0.42 | -0.22 | -0.33 | 0.37 | -0.31 | -0.24 | -0.32 |
| | Housing transactions | -0.09 | -0.05 | -0.04 | 0.05 | 0.02 | -0.14 | -0.10 | -0.12 | -0.25 | -0.05 | -0.16 | -0.08 | -0.08 |
| Market | Hiring rate | -0.63 | -0.70 | -0.55 | -0.47 | -0.83 | -0.02 | -0.37 | -0.37 | -0.50 | -0.07 | -0.50 | -0.01 | -0.48 |
| | Private sector wages | -0.31 | -0.25 | -0.30 | -0.18 | -0.35 | -0.13 | -0.18 | -0.12 | -0.23 | -0.07 | -0.24 | -0.15 | -0.21 |
| Financial | Separation rate | -0.39 | -0.47 | -0.48 | -0.22 | -0.61 | 0.18 | -0.14 | -0.14 | -0.48 | -0.05 | -0.59 | 0.21 | -0.31 |
| | Quit rate | -0.63 | -0.51 | -0.75 | -0.46 | -0.85 | 0.03 | -0.34 | -0.21 | -0.53 | 0.12 | -0.61 | -0.05 | -0.49 |
| Markets & Credit | Job-to-job rate | -0.63 | -0.67 | -0.64 | -0.45 | -0.81 | 0.06 | -0.32 | -0.33 | -0.55 | 0.00 | -0.58 | 0.04 | -0.50 |
| | Credit spreads | 0.42 | 0.09 | 0.56 | 0.40 | 0.55 | 0.24 | 0.24 | -0.09 | 0.30 | -0.35 | 0.37 | 0.29 | 0.30 |
| Credit | FTSE 250 | -0.21 | -0.09 | -0.09 | -0.16 | 0.03 | -0.50 | -0.17 | 0.00 | -0.23 | -0.16 | -0.10 | -0.55 | -0.16 |
| | 10-year gilts | -0.23 | -0.04 | -0.19 | -0.04 | -0.18 | -0.39 | -0.29 | -0.06 | -0.24 | 0.03 | -0.16 | -0.43 | -0.18 |
| Median of correlations | | -0.33 | -0.29 | -0.33 | -0.23 | -0.32 | -0.17 | -0.29 | -0.14 | -0.23 | 0.01 | -0.18 | -0.21 | -0.18 |

Note: Based on data from 1996Q1-2016Q2.

Second, in terms of evaluating which measures of uncertainty are more tightly linked to movements in the economy, the Bank of England's principal component measure (which is the main measure of uncertainty used in MPC forecasts) does quite well. It has the strongest correlation with GDP and relatively darker cells for most economic measures and across different segments of the economy. The three individual uncertainty measures most correlated with GDP (other than the principal component) capture very different types of uncertainty: sterling volatility, unemployment uncertainty, and the dispersion of company earnings' forecasts. This confirms the point highlighted in the previous section; in order to capture the effects of uncertainty on the economy, it is important to directly measure different types of uncertainty - including in financial markets, on consumers, and on businesses. The BoE's principal component measure should accomplish this.

Third, and in contrast, other uncertainty measures show a weaker relationship with key economic variables. For example, two popular measures of uncertainty used in academic research, the Economic Policy Uncertainty Index (from Baker, Bloom and Davis, 2016), and especially the Global Political Risk Index (from Caldara and Iacoviello, 2016), have weaker correlations with key economic variables, including GDP. In terms of the individual uncertainty measures used to construct the Bank of England's principal component, the uncertainty measures based on media citations, GDP growth forecast dispersions, and FTSE volatility have the lowest correlations with the economic variables, including with GDP. This agrees with results in Caldara *et al.* (2016), which finds that measures of uncertainty based on real economic data (such as dispersions in forecast errors) generate significant declines in real economic activity, while uncertainty measures based on stock market data or economic policy news, have no significant effect. This could also be important in assessing the recent impact of heightened uncertainty in the UK. Two of the main factors behind the sharp upward spike in the BoE uncertainty index has been the increase in media citations referring to uncertainty and the dispersion in GDP growth forecasts. If these measures have less impact on economic activity (as suggested in Figure 7), one might expect less drag on GDP from the recent increase in uncertainty than has traditionally occurred and when uncertainty increases due to other components.

A final noteworthy pattern is the relative strength of the correlations between the different uncertainty measures and the different segments of the economy. Uncertainty measures seem to have some of the strongest links with the labour market (especially with hiring, quits, and job-to-job flows) and with the housing market (especially with prices for housing and CRE). The fact that many uncertainty measures have a weaker correlation with investment than many of the other variables is noteworthy, especially as the academic literature has focused on the negative effects of uncertainty on investment. Although the other channels have received some attention, they are generally not believed to be as large in magnitude or as important in explaining fluctuations in GDP. Yet, in the UK, uncertainty generally moves more closely with consumption (with a median correlation of -38% across all the measures) than with investment (with a median correlation of -19%). One possible explanation is that the effect of uncertainty on investment is more lagged, but the same analysis with uncertainty lagged by 1 or 2 quarters yields even lower correlations with investment. Another challenge is that these correlations do not capture causation, so that high correlations may not just capture how uncertainty affects that variable, but also how that variable affects uncertainty, or

how they both are simultaneously affected by a third variable. While all of these considerations could be important, the correlations still suggest that the effects of uncertainty on the economy may be more broadly based than generally believed, and occur through other important channels than investment.

To further explore the dynamics of the effects of uncertainty on investment and consumption, as well as to evaluate the possibility of longer lags, I perform a simulation for the UK. I estimate the effects of uncertainty using a VAR model similar to that described in Haddow *et al.* (2013), and incorporate the estimated effects into COMPASS - the standard forecasting model used by the Bank of England.¹⁶ I assume that the BoE's principal component measuring uncertainty increases by one standard deviation (about one-third of the increase that occurred from its recent trough to its post-referendum peak). I also assume that the exchange rate and monetary policy are unchanged. Figure 8a shows the resulting estimated effects on consumption and investment. The peak impact on both consumption and investment is lagged by several quarters, with the largest effect occurring a little over a year after the increase in uncertainty. The impact on consumption growth is estimated to be a small fraction of the impact on investment growth; two years after uncertainty increased, the fall in consumption is around 10% of the fall in investment.

Next, Figure 8b uses the same simulation to estimate the impact on aggregate expenditure growth (the black line), broken into the three components on which it has the largest effect (consumption, investment, and imports).¹⁷ Expenditure growth slows gradually, with a maximum drag of 0.5% qoq after 4 quarters. Weaker imports dampen some of the negative impact on output, while consumption and investment both drag significantly on growth. Most interesting, however, are the relative contributions of investment and consumption to slower expenditure growth. Even though uncertainty has a significantly greater effect on investment than consumption (as shown in Figure 8a), since consumption is a significantly greater share of aggregate expenditure than investment, the overall contribution of weaker consumption to the slowing in growth is very important and not far off that from investment. The drag on expenditure from consumption peaks at -0.25 pp, while that from investment peaks at -0.4 pp.

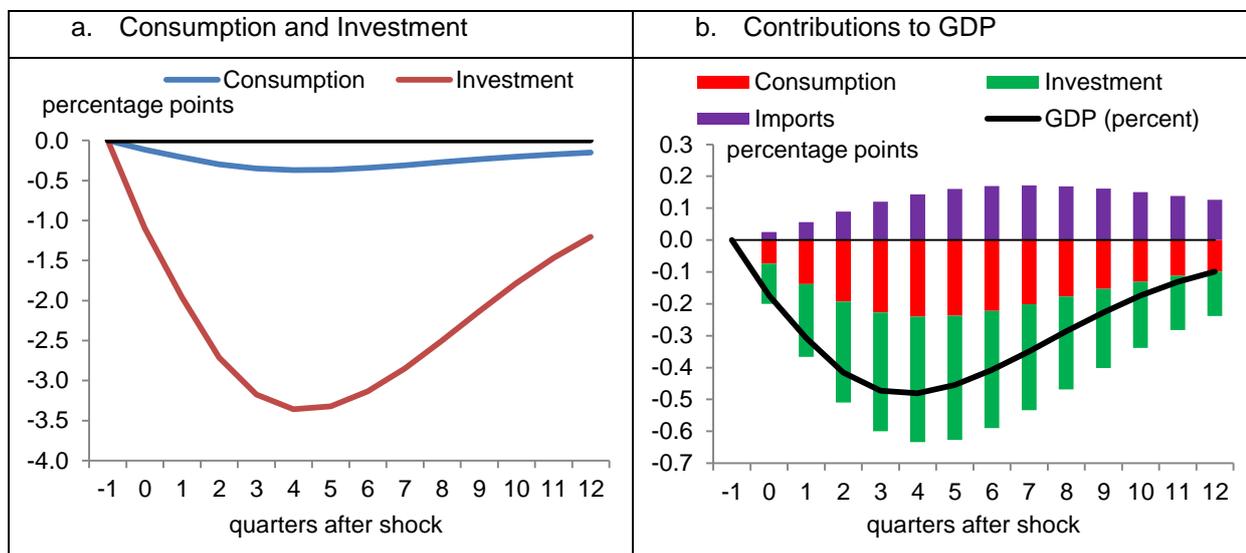
To summarize, this closer look at how uncertainty is related to various segments of the economy has highlighted several key points. First, the effects of uncertainty are manifest in many ways and hard to capture in a single statistic that only focuses on one sector of the economy; there are advantages to using some type of index or principal component that captures these different aspects of uncertainty. Second, some indicators of uncertainty that have recently increased sharply (such as media references and the dispersion of GDP growth forecasts) tend to be less correlated with important economic indicators. Third, uncertainty can have meaningful effects on the economy through channels other than just investment - including significant effects through consumption. Finally, uncertainty not only reduces demand in an economy through numerous

¹⁶ For further details, see Burgess *et al.* (2013).

¹⁷ Uncertainty has a negligible impact on the other expenditure components (government spending, exports and other investments), so they are not shown.

channels, but can also reduce the supply potential of the economy. This implies that heightened uncertainty could lead to lower or higher inflation, therefore making the appropriate monetary response less clear-cut.

Figure 8. The effect of an increase in uncertainty



Note: The estimated impact of a one standard deviation increase in uncertainty, as measured by the BoE's principal component. Monetary policy and the exchange rate are assumed to remain unchanged.

III. How will Heightened Uncertainty Affect Growth and Inflation in the UK?

It is now time to move to the most important question related to uncertainty today - at least for someone tasked to set monetary policy in the UK – how will the recent increase in uncertainty around the UK's relationship with the European Union affect output and inflation? In order to answer this question, it is helpful to build on several insights from above. First, uncertainty should be measured using some type of broad index or principal component that captures its various manifestations - including uncertainty relevant to consumers and businesses. For this, the Bank of England's principal component measure seems better than any individual measures or any popular measures used in other research papers. Second, uncertainty can affect the economy through various related channels, and clearly in more ways than just reducing investment (including through consumption, productivity growth, the labour market and housing market). As a result, focusing on the aggregate effects on the economy, instead of trying to estimate each of these specific channels and then aggregating these individual estimates, seems a logical approach.

Those were the easy decisions.

Now the really hard work starts.

In order to estimate the effect of heightened uncertainty on the broader economy, it is necessary to make three additional and critically important assumptions. First – how will uncertainty evolve in the future? For example, will uncertainty increase or decrease from its current elevated level - especially after Article 50 is

invoked? Second, should we adjust our measure of uncertainty to put more weight on indicators that have stronger relationships with key economic variables? For example, should we put less weight on some of the measures of uncertainty included in our principal component that have recently spiked (such as media references to uncertainty and the dispersion in GDP growth forecasts) but have weak relationships with GDP? Finally, saving the hardest for last, how does one identify the impact of uncertainty? For example, if past increases in uncertainty correspond to tighter credit conditions, is it possible to isolate the impact of heightened uncertainty when it does not correspond to tighter credit conditions?

This section will take each of these questions in turn. It will show that each of these assumptions is critically important for the economic forecast and monetary policy. The answers to the last two questions may also explain why heightened uncertainty around the time of the referendum on EU membership has had less impact on the broader economy, to date, than expected given past relationships.

The Path for Uncertainty

To begin, Figure 9 shows the MPC forecasts for GDP growth (panel a) and CPI inflation (panel b) from the November *Inflation Report* (in black lines). This forecast incorporates the impact of uncertainty as measured by the BoE principal component. Uncertainty is assumed to remain elevated through the forecast period, weighing on both supply and demand.¹⁸ Annual GDP growth is expected to slow to a trough of 1.2% by the end of next year, and CPI inflation pick up to a peak of 2.8% in mid-2018.

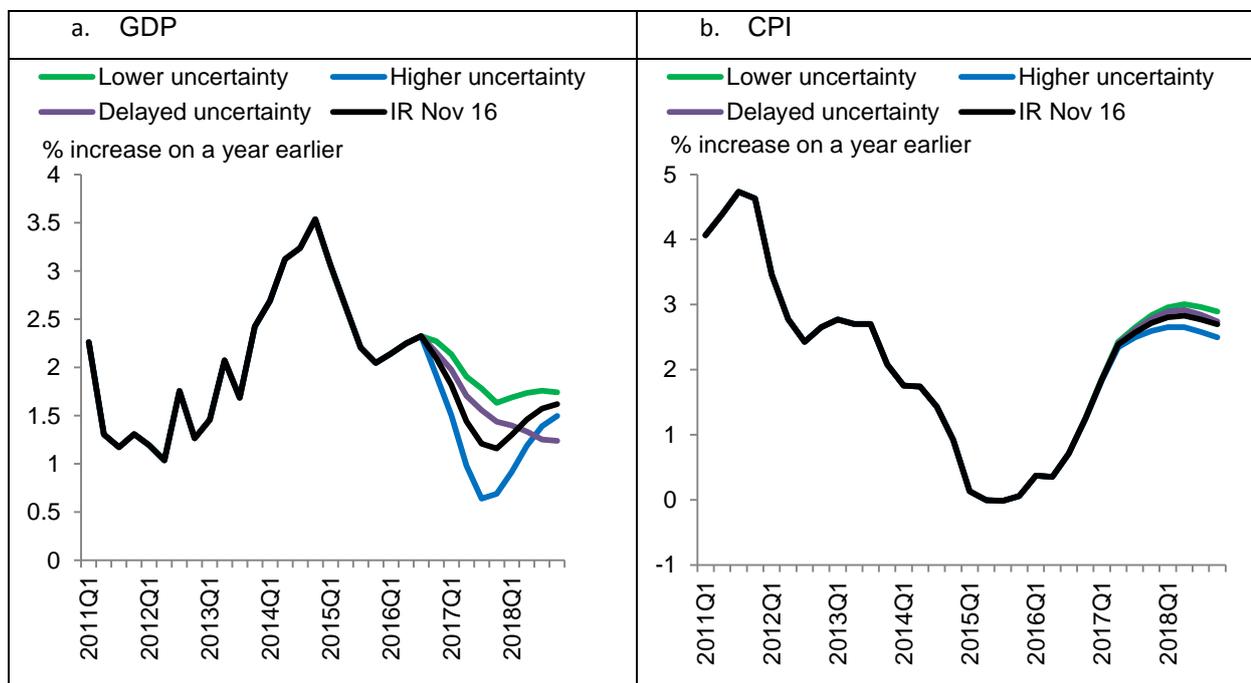
What would happen if uncertainty followed a different path? To see how this one change might affect the forecast, I consider scenarios with higher and lower uncertainty paths (as compared to the path assumed in the November *Inflation Report* forecast), as well as a scenario with a delayed increase in uncertainty. In the higher uncertainty scenario (in blue), uncertainty picks up much more sharply than currently expected and then falls back slowly to end the forecast period one standard deviation higher than in the baseline scenario. In the lower uncertainty scenario (in green), uncertainty falls gradually over the rest of this year to its historic average of 0, and ends the forecast one standard deviation lower than in the baseline scenario. In the delayed uncertainty scenario (in purple), uncertainty remains at its current level through May 2017, then increases gradually for about a year, before falling back towards 1 standard deviation by the end of the forecast horizon (and ending exactly in the middle of the higher and lower uncertainty scenarios).

The resulting paths for output under these three scenarios are shown next to the baseline forecast in Figure 9a. Annual growth falls by significantly more in the high uncertainty scenario – troughing at almost 0.6% instead of 1.2%. Growth falls more moderately in the low uncertainty scenario, never reaching as low as 1.5%. In the delayed uncertainty scenario, growth falls more gradually, but is still only 1.3% after 2 years, which is below the higher uncertainty scenario. These scenarios show that assumptions about the path for

¹⁸ See Section 5 in the November *Inflation Report*.

uncertainty could have first-order effects on the path for growth, and therefore for unemployment and the size of any output gap.

Figure 9. Scenarios based on different paths for uncertainty in the future



Note: IR Nov 16 refers to the MPC's November 2016 *Inflation Report* modal projections for GDP and CPI, respectively.

These different paths for uncertainty, however, have much smaller effects on the forecast inflation rate, as shown in Figure 9b. Inflation peaks at 2.8% in the baseline case, 2.7% in the higher uncertainty scenario, 3.0% in the lower uncertainty scenario, and 2.9% in the delayed uncertainty scenario. In all four scenarios, inflation ends the forecast period above target - ranging from 2.3% to 2.7% in 3 years. These scenarios, however, all assume that there is no change in monetary policy or the exchange rate relative to the original assumptions in the baseline uncertainty case - even though uncertainty has followed a different path. In other words, all four scenarios are based on the market curve for interest rates and the level of sterling as used for the November *Inflation Report*. If uncertainty followed one of these different paths, however, monetary policy could also follow a different path.

Moreover, the implications for monetary policy from the different uncertainty paths would likely be more than implied by just looking at the fairly similar inflation paths. In the current baseline forecast, growth falls below potential, unemployment increases, and the output gap becomes negative. Monetary policy should balance supporting demand and returning inflation to target in the medium term on a sustainable basis; this trade-off was critical in the MPC's decision not to tighten monetary policy in November, despite inflation being expected to overshoot 2% over the next 2-3 years. If uncertainty evolved following a path closer to the lower uncertainty scenario, however, there would be little increase in unemployment and only a very small output gap. This would involve less of a trade-off and less reason to tolerate an inflation overshoot without tightening monetary policy. On the other hand, if uncertainty followed the higher uncertainty profile, the MPC

might possibly be willing to look through a slightly higher overshoot of inflation than currently forecast. Or, potentially most difficult, if uncertainty did not increase over the next few months, but is expected to increase sharply next spring after Article 50 was triggered (possibly something closer to the delayed uncertainty path), then any weakness in the economy might not be apparent for even longer. Each of these scenarios would undoubtedly generate robust discussion by the MPC.

The bottom line is that the path for uncertainty is central to the trade-off facing the MPC today – and therefore for monetary policy.

The Measure of Uncertainty

The way in which uncertainty is measured is also central to the economic forecast and monetary policy. Section I and Figure 4 showed that the BoE's standard measure of uncertainty spiked around the time of the referendum, but that this spike reflected a divergence in the underlying data series used to construct the principal component. The recent spike in this uncertainty measure primarily reflected sharp increases in three of the underlying components: sterling volatility, media references to uncertainty, and the dispersion of GDP growth forecasts. The other five measures of uncertainty used to construct the principal component have been remarkably stable in recent months. Moreover, Section II and Figure 7 showed that two of the three measures that have recently spiked (of media references to uncertainty and the dispersion of GDP forecasts) were some of the least correlated with key measures of economic activity (including GDP).

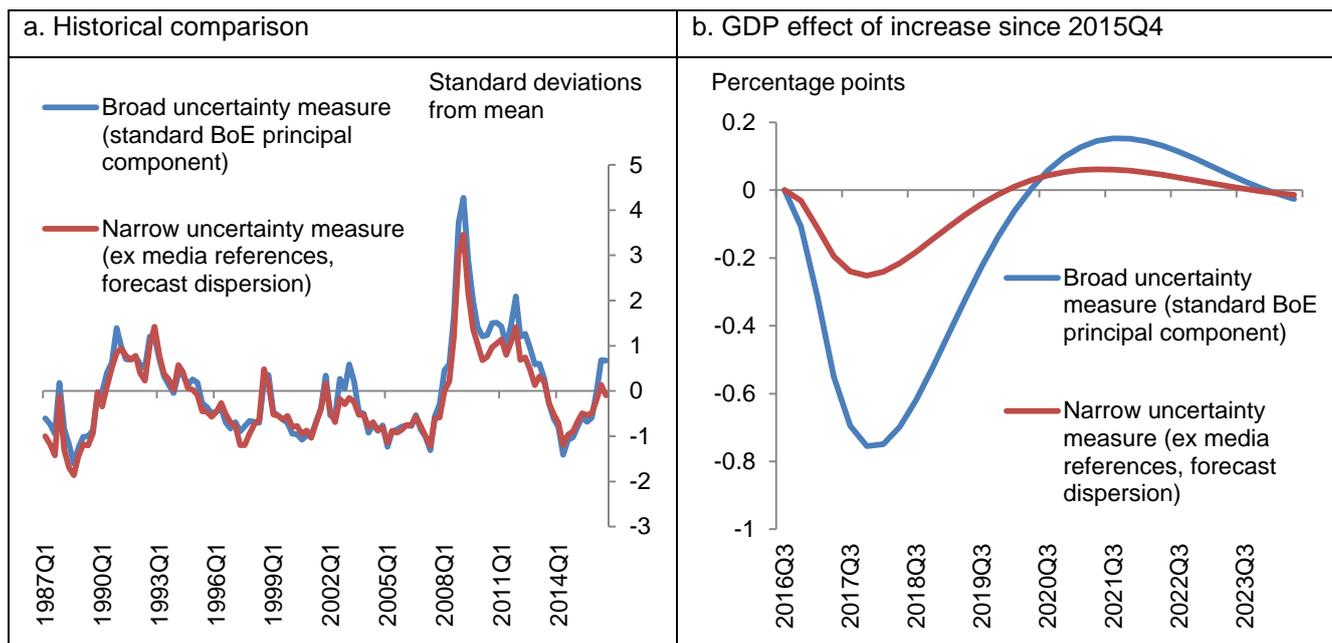
Could we be overestimating the impact of uncertainty because our measure spiked largely due to components that have the weakest relationship with economic activity? To test this, I construct an alternative principal component measure of uncertainty - which I will call the narrow BoE measure. This narrow measure uses the same methodology as the BoE's broad measure, and the same set of underlying components, except excludes the two components that have the weakest correlations with GDP. This narrow measure is therefore still broadly based (despite its name) and should still capture the multifaceted nature of uncertainty and its ability to affect various segments of the economy. Figure 10a shows the resulting paths for the two different quarterly measures of uncertainty. They generally move together closely, although there are a few periods where they have diverged – especially since the end of 2015. The broad uncertainty indicator has increased by 1.3 standard deviations since end-2015, while the narrow indicator has increased by only 0.4 standard deviations over the same period.

Next, I run an SVAR which estimates the impact of heightened uncertainty in the UK economy using either the standard (broad) BoE principal component or the narrow measure. The SVAR model follows the general setup in Gilchrist *et al.* (2014) and focuses on the relationship between 6 variables: uncertainty, corporate borrowing spreads, GDP, consumption, business investment, hours worked, CPI inflation, and Bank Rate.¹⁹

¹⁹ The SVAR is estimated on quarterly data from 1987q2 to 2016q2. The business investment, consumption, GDP, CPI and hours series have been detrended using an HP-filter with a smoothing parameter $\lambda=1,600$; uncertainty, Bank Rate and corporate borrowing spreads

Figure 10b shows the estimated impact on GDP of the recent changes in the two different uncertainty measures. There are starkly different predictions for output, and therefore growth. The forecast based on the broader uncertainty measure (in blue) implies a substantially greater decline in GDP. The peak effect is a contraction of around 0.7 percent relative to trend. In contrast, the predicted decline in GDP based on the narrow measure (in red) is significantly smaller, peaking at a contraction of only 0.2 percent. In other words, the narrow measure of uncertainty would imply a substantially smaller slowing in GDP growth than predicted based on the standard BoE measure.

Figure 10. Broad vs narrow principal component measures of uncertainty



Moreover, as discussed above, these different forecasts for GDP could have important implications for the current monetary policy trade-off – even if there is little difference in the corresponding inflation forecasts. The growth forecast based on the standard BoE measure of uncertainty is substantially weaker and corresponds to a larger output gap. As a result, this implies a more difficult trade-off for monetary policy as inflation overshoots the 2% target. The growth forecast based on the narrower measure of uncertainty (which excludes the two components that are less correlated with economic variables), suggests less weakness in GDP, a smaller output gap, and therefore less of a trade-off for monetary policy.

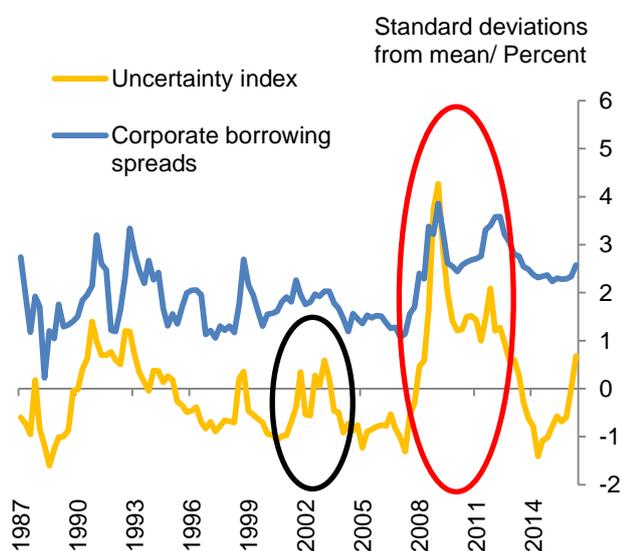
The bottom line is that how uncertainty is measured can have material implications for our economic forecast and the corresponding path for monetary policy. Challenges in measuring uncertainty, and especially putting too much weight on less informative measures (such as media citations and GDP forecast dispersions), could have recently caused us to overestimate the impact of heightened uncertainty on the economy.

are in levels. The effect of the uncertainty shock is estimated using a recursive identification scheme (or a Cholesky decomposition), where uncertainty is ordered last, meaning that shocks to uncertainty affect the other variables in the model with a one-quarter lag.

Isolating the Effects of Uncertainty from those in Credit Markets

A final issue related to uncertainty that is critical for the MPC today is how much of the estimated effect of uncertainty results from the tighter credit conditions that usually correspond to heightened uncertainty – effects which might not occur if credit conditions did not deteriorate. Figure 11 captures this challenge. The yellow line is the standard BoE principal component measuring uncertainty (based on the broader set of 8 variables) and the blue line is a measure of corporate borrowing spreads (a measure of credit conditions). These two measures usually move together fairly tightly (with a correlation of 0.73). Both have seen their sharpest increases during the same periods – such as around 1991 prior to the UK leaving the ERM (and allowing sterling to float), in 1998 when a large hedge fund collapsed (and generated turmoil in financial markets), and in 2008 during the global financial crisis (when both measures increased to their highest levels since the graph started).

Figure 11. UK uncertainty and credit spreads



When our models estimate the impact of heightened uncertainty on the economy, however, are they capturing just the effect of uncertainty? Or are they also capturing the indirect effect of the increase in borrowing spreads which tends to occur simultaneously (and which may partly reflect heightened uncertainty, but also other variables)? Are the estimated and large effects of uncertainty driven by periods when both uncertainty and credit spreads spiked – especially by the large movements around the global financial crisis? If uncertainty increases but corporate borrowing spreads are relatively stable – will there be as large an economic effect?

This issue of identifying the distinct effects of uncertainty from those of other types of financial shocks has recently been highlighted by several papers in the academic literature. This literature discusses how uncertainty tends to move in conjunction with not only corporate borrowing spreads, but also the yield curve, exchange rate, other credit spreads, and even commodity prices for some countries. Most papers make no attempt to isolate the various effects, as there is no straightforward way to distinguish them. The few papers that do try to isolate the effects generally find that both uncertainty and financial shocks affect various economic measures, but the impact of uncertainty shocks is significantly weaker when distinguished from financial shocks and/or financial frictions.²⁰ Some papers even find that, under certain setups for their estimation, the effects of pure uncertainty shocks are no longer significant in isolation.

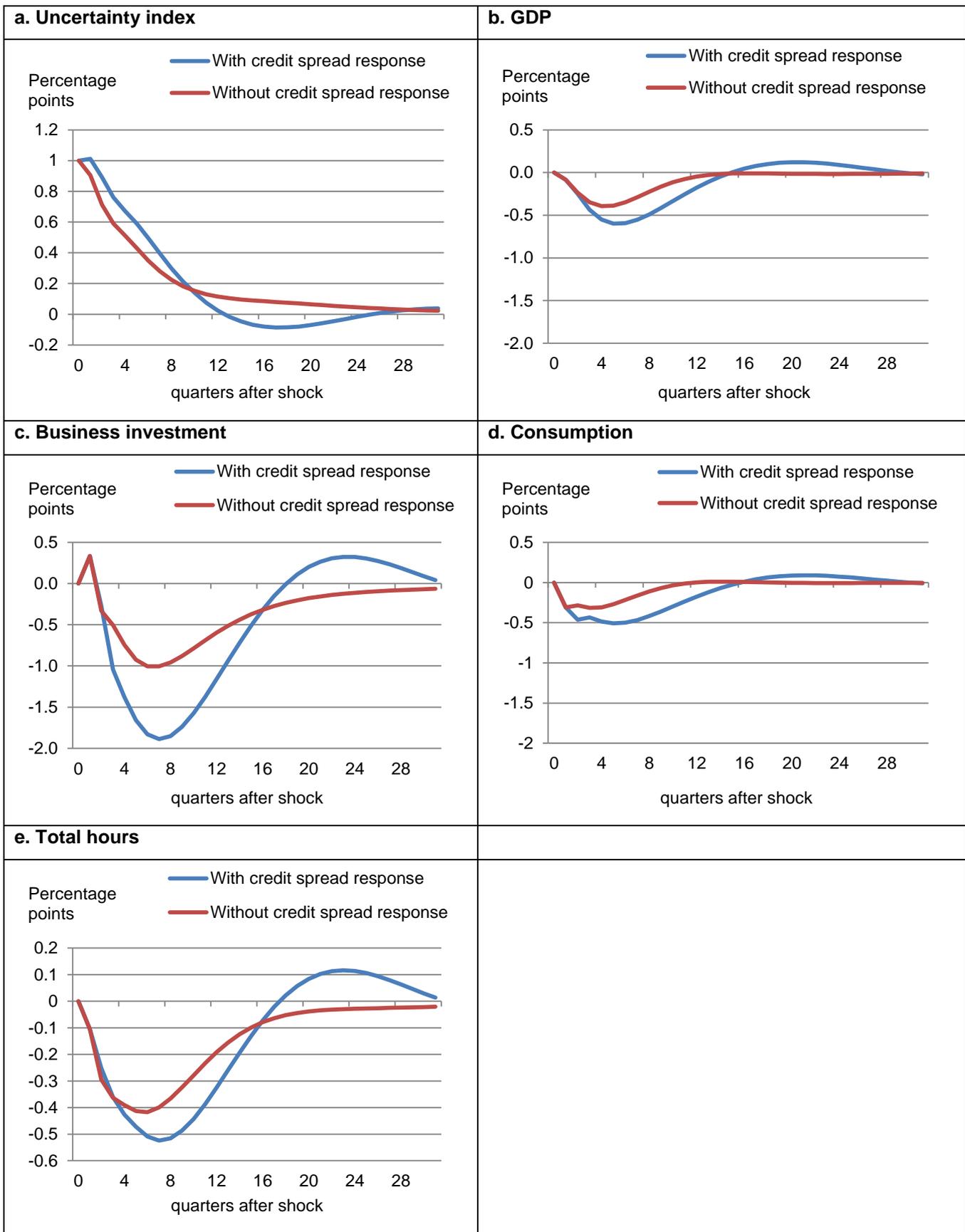
²⁰ See Caldara, Fuentes-Albero, Gilchrist and Zakrajsek (2016), Gilchrist, Sim and Sakrajsek (2014), Alfaro, Bloom and Lin (2016), Arellano *et al.* (2012), and Cesa-Bianchi, Pesaran and Rebucci (2014). Christiano, Motto and Rostagno (2014) argue that uncertainty shocks are more important than various financial shocks, but uncertainty works primarily through generating a higher cost of borrowing.

Gilchrist, Sim and Sakrajsek (2014) present a case study that highlights the importance of distinguishing between the effects of uncertainty and changes in credit conditions. They show that after the US stock market crash in 1987, there was a large increase in US uncertainty measures, but no substantial increase in credit spreads. They also find little effect of uncertainty and heightened volatility on the broader US economy at this time. This is far from definitive, but supports their hypothesis; financial conditions are an important channel by which uncertainty affects the broader economy. If uncertainty does not affect credit conditions, movements in uncertainty would have less impact on the economy.

Does this also apply to the UK? The Appendix performs a similar case study for the UK. It examines the performance of GDP, consumption and investment during two periods (identified with circles in Figure 11) when uncertainty increased: around 2002 and 2008. In the first episode, credit conditions were fairly stable, while in the second episode they tightened sharply. The effects on real activity in 2002 were much more moderate, with only a small and short-lived slowdown in business investment, and no discernible impact on consumption or GDP, despite heightened uncertainty. These smaller effects on real activity from heightened uncertainty in 2002 remain, even after adjusting for the relative magnitudes of the changes in uncertainty across these periods. This comparison of the effects of heightened uncertainty in 2002 (when there was no corresponding tightening in credit conditions) with the episode in 2008 (when credit conditions tightened sharply) is obviously only suggestive. There are many other differences across these two episodes – and many reasons why real economic activity was substantially weaker in 2008 than in 2002. Nonetheless, this simple comparison does support the recent evidence in the academic literature that uncertainty could have less malignant effects on the real economy when credit conditions are relatively stable.

In an attempt to test this hypothesis more formally, I will discuss one last piece of analysis. I re-estimate the SVAR model used earlier, using the standard BoE principal component measuring uncertainty. This framework allows for credit spreads to adjust automatically in response to various shocks (including uncertainty shocks). Then I assume a 1 unit increase in uncertainty (which is somewhat smaller than the 1.3 standard deviation increase that occurred in the UK since end-2015). The blue lines in each of the panels in Figure 12 show the estimated impulse responses for GDP, investment, consumption, and hours worked. As expected, economic activity falls for each of these four measures, with the sharpest fall in investment.

Figure 12. SVAR impulse responses to an uncertainty shock – with and without increase in credit spreads



Next, I repeat the same exercise, except keep credit spreads unchanged.²¹ This is not the same as controlling for any independent financial shocks, but given the challenges in accurately identifying and isolating these effects from uncertainty, this is a good approximation. The red lines in each of the panels in Figure 12 show the estimated effects. GDP, investment consumption, and hours worked still fall, but by less than when credit spreads also tighten simultaneously. More specifically, investment falls by about half relative to in the base case; consumption falls by about 60%, and GDP by about two-thirds of that in the base case. Moreover, this reduced drag on real activity occurs despite the fact that monetary policy is tighter in the simulation with no impact on credit spreads; if monetary policy was constant in these two scenarios, the differences between these two scenarios would be even greater.

Although these scenarios should only be interpreted as rough simulations, they clearly suggest that the impact of heightened uncertainty on real activity could be substantially smaller if credit conditions do not simultaneously tighten. This has important implications for understanding and estimating the impact of uncertainty on the UK economy today. Although uncertainty has increased by many measures, including in the BoE's principal component, credit spreads have not increased to nearly the same degree. In fact, credit spreads remained relatively stable during the period of heightened uncertainty just before the referendum, and fell immediately afterward, at least partly reflecting the MPC's package of monetary easing. This is also supported by the BoE survey of credit conditions,²² which shows that credit availability for households and firms remained stable in the third quarter of 2016. This stability in financial conditions and credit markets has helped support real activity in the UK, and may partially explain why uncertainty has seemed to create less drag than generally expected. For example, investment and housing have weakened somewhat less than expected, and consumption and GDP growth have been substantially stronger than expected. Although it is impossible to know the counterfactual, there does not appear to be a significant drag from uncertainty – at least not yet – on these measures of activity. Moreover, this analysis also suggests that this attenuated effect of uncertainty may persist if credit conditions remain supportive.

IV. Conclusions

What have we learned? Measuring uncertainty is hard. Measuring the impact of uncertainty on the economy is even harder. Its effects are multifaceted and work through much more than just business investment. Predicting the impact of uncertainty on the economy in the future is even harder still. Heightened uncertainty can have different effects based on credit conditions. Heightened uncertainty can not only weaken demand, but also the supply potential of an economy, making it more challenging for monetary policy to cushion its effects.

There is much uncertainty about uncertainty.

²¹ More specifically, I assume positive credit shocks which offset the negative effect from uncertainty on credit spreads. There is also a small impact on the uncertainty measure, as shown in panel a.

²² Bank of England *Credit Conditions Survey 2016 Q3*. Available at: <http://www.bankofengland.co.uk/publications/Pages/other/monetary/ccs/2016/q3.aspx>.

Yet, as Voltaire said, “Uncertainty is an uncomfortable position. But certainty is an absurd one.”

Although most measures of UK uncertainty are higher today than their historic averages, there is always uncertainty. Central banks are accustomed to operating under uncertainty; we must constantly make decisions based on predictions of highly uncertain variables in the future. Heightened uncertainty is no reason to change our approach to monetary policy. Unlike the 15th and 16th century monarchs, we have no whipping boy who will take the pressure off.

Moreover, the strength of the UK economy during the period of heightened uncertainty before and after the referendum on EU membership suggests that uncertainty is dragging less on growth than has traditionally occurred. I have shown evidence for two possible explanations.

First, some of the factors recently driving up uncertainty indices – such as heightened media attention and a wider dispersion in GDP growth forecasts – tend to have smaller effects on the broader economy than other measures of uncertainty. Adjusting uncertainty measures to reduce the importance of these less informative components suggests a smaller drag on growth from the recent increase in uncertainty.

Second, heightened uncertainty usually corresponds to tighter credit conditions. When it does not, uncertainty seems to have less impact on the broader economy. Recently, most measures of credit conditions (such as corporate bond spreads and access to credit) have not tightened sharply. As a result, one of the standard mechanisms by which uncertainty traditionally slows growth may be less important today.

Nonetheless, even though heightened uncertainty has recently appeared to have less effect on the UK economy than expected, that does not mean that it has had no effect, or will have no effect in the future. Most business surveys suggest that some companies are already delaying investment, or expect to do so over the next year. Some of the effects of heightened uncertainty only occur with substantial lags, including not just weaker investment, but also weaker wages and productivity growth, and therefore eventually weaker income and consumption. The effects of uncertainty through weakening the supply potential of the economy are likely to be even slower. Heightened uncertainty could have a larger or smaller impact over time if it continues for a prolonged period. And UK uncertainty measures could quickly shift – up or down – as more details on the future arrangement between the UK and EU are clarified.

The MPC will continually be assessing the effects of uncertainty. We will also do what we can to reduce uncertainty when possible – such as by focusing on our remit, clarifying that we have the tools to either tighten or loosen monetary policy as needed, explaining how we make our decisions, and discussing the key variables that will be critical to these decisions. Uncertainty is just one of those variables.

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Appendix

This appendix performs a case study of UK economic performance during two periods of heightened uncertainty: one when credit conditions simultaneously tightened, and one when credit conditions remained relatively stable. It is only one example, but supports the hypothesis discussed in Section III that economic performance may be less affected by heightened uncertainty if such an increase in uncertainty does not correspond to tighter credit conditions.

Figure 11 suggests that there are limited episodes when a sharp increase in uncertainty did not correspond to a sharp increase in corporate borrowing spreads. The best example is in 2001 through early 2003 (hereafter the “2002 episode”), when uncertainty increased to above its historic average, but corporate borrowing spreads were fairly steady and then fell slightly. This was the period after the Sept 11th terrorist attacks in the US, and then the subsequent invasion of Afghanistan, increase in oil prices, and bursting of the technology bubble.

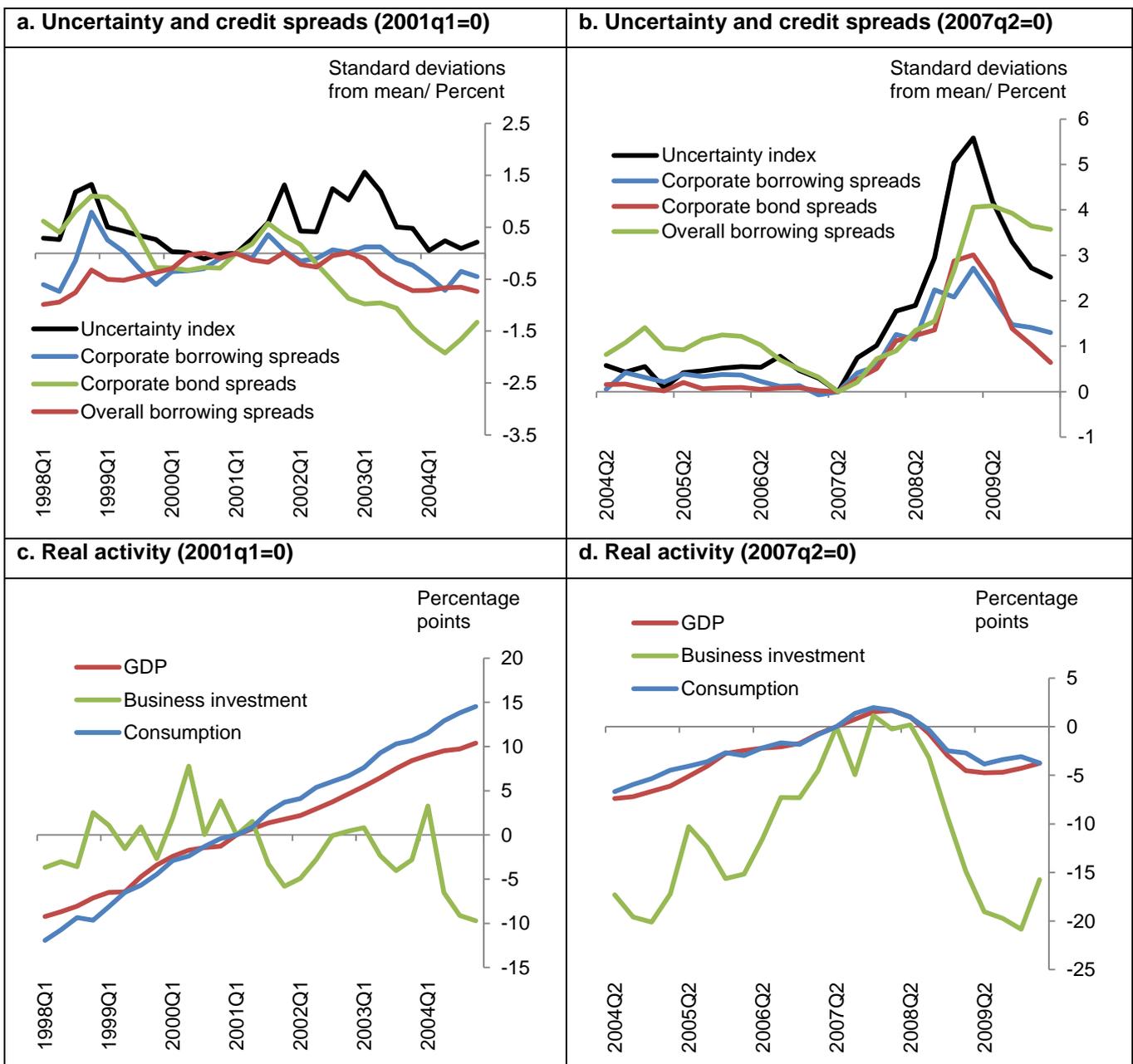
Next, in order to assess what happened to the economy during this period of heightened uncertainty (but not heightened credit spreads), I will make several comparisons to the period around 2008 – when both uncertainty and credit spreads were sharply elevated. To clarify the comparison and different developments in financial markets over these periods, the left side of Appendix Figure A shows trends during the earlier episode around 2002, and the right side shows the same data for the later period around 2008. Panels a and b show the evolution of uncertainty (which increased in both periods, albeit more sharply in 2008), and of several measures of credit conditions – overall credit spreads, corporate bond spreads, and corporate borrowing spreads (which all increased sharply in 2008, but not in 2002). Next, panels c and d show the corresponding trends in real activity, measured by the cumulative changes in the levels of GDP, consumption and business investment. All measures of real activity fell sharply after 2007, especially business investment. The effects in 2002 were much more moderate, however, with a small and short-lived slowdown in business investment (note the difference in the scales on the two graphs), and no discernible impact on consumption or GDP.

Of course, given the much larger increase in uncertainty during 2008 relative to 2002, one would have expected a larger and more discernible impact on real activity in the later episode. Therefore, in order to assess if the smaller impact on real activity in 2002 was simply proportional to the smaller increase in uncertainty that occurred at that time, panels e and f plot the standardized growth rates in GDP, investment and consumption in the three years after 2001 q1 and 2007 q2, respectively, against the uncertainty measure. Panel e shows that the increase in uncertainty in the 2002 episode was associated with marginally lower GDP, consumption and investment growth - but the coefficients are all close to zero, the lines are close to flat, and the regressions have little explanatory power (as shown by the low R^2 's). In contrast, the estimated correlations during the 2008 crisis period were much bigger; the lines are very steep, and the explanatory power of the simple regressions much higher. There is no evidence that the weaker impact of

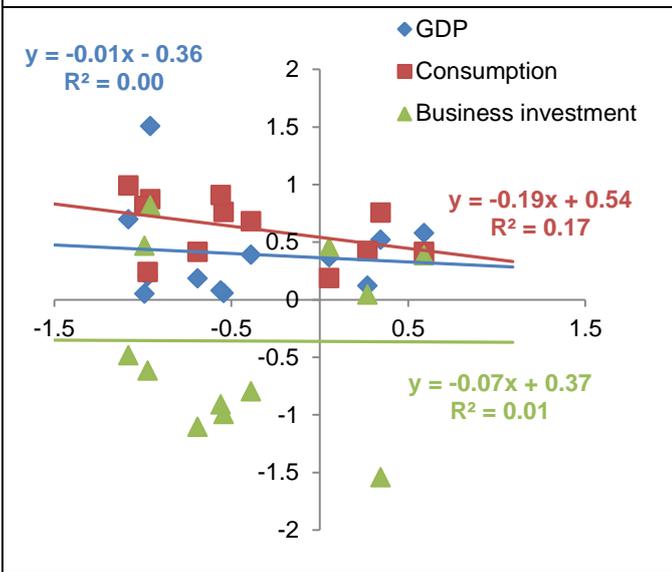
uncertainty in 2002 relative to 2008 corresponded to the smaller movement in uncertainty in the earlier period.

This comparison of the effects of heightened uncertainty in 2002 (when there was no corresponding tightening in credit conditions) with the episode in 2008 (when credit conditions tightened sharply) is obviously only suggestive. There are many other differences across these two episodes - and many reasons why real economic activity was substantially weaker in 2008 than in 2002. Nonetheless, this simple comparison does support the recent evidence in the academic literature that uncertainty could have less malignant effects on the real economy when credit conditions are relatively stable.

Appendix Figure A. Two episodes of heightened uncertainty in the UK



e. Relationship between Uncertainty (x-axis) and GDP, Consumption, Business Investment growth (y-axis) in the three years after 2001q1



f. Relationship between Uncertainty (x-axis) and GDP, Consumption, Business Investment growth (y-axis) in the three years after 2007q2

