

Assessing the risk to inflation from inflation expectations

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Inflation expectations play an important role in the transmission mechanism of monetary policy. There is a risk that the periods of above-target CPI inflation in the past three years might cause inflation expectations to drift upwards. That might make inflation itself more persistent, via changes in price and wage-setting behaviour. And so, other things being equal, returning inflation to target would require tighter monetary policy. This article provides a framework that can be used to monitor the risk to inflation from inflation expectations. While recent developments provide few signs that the risk is materialising, the imperfect nature of data mean that the risk can be assessed only imperfectly.

Introduction

Over the past three years, inflation, measured by the annual change in the consumer prices index (CPI), has frequently been more than 1 percentage point above the 2% target set by the Government and has averaged 3.2% during that period (Chart 1). The elevated rate of inflation reflects the temporary effects of a number of factors including: increases in food and energy prices; higher import prices following the substantial depreciation in sterling; and increases in the standard rate of VAT. The outlook is highly uncertain, but the Monetary Policy Committee (MPC) judges that inflation is likely to remain elevated throughout the remainder of 2011, before falling back during 2012 as the temporary effects wane and downward pressure from spare capacity persists.⁽²⁾

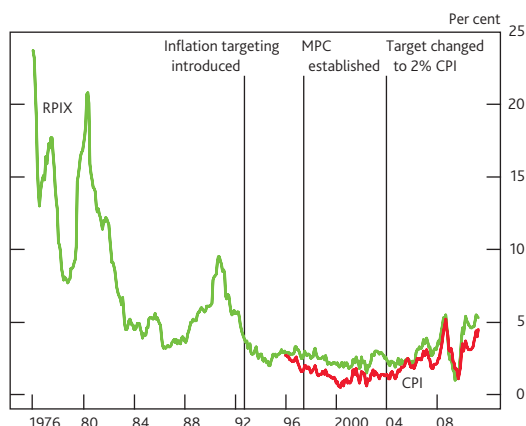
There is a risk that recent high inflation outturns might prompt households, companies and financial market participants to

expect inflation to persist above the target. That might happen if they believe that the MPC has become more tolerant of deviations of inflation from target in the near term than is in fact the case. Or individuals might have doubts about the willingness or ability of the MPC to return inflation to target in the medium term. In either case, expectations of inflation would have become less well anchored by the monetary policy framework.

If inflation expectations were to become less well anchored, inflation itself might become more persistent. That might occur through a change in price-setting or wage-setting behaviour. For example, if companies were to believe that inflation would remain above the target for longer, then they might raise the prices of the goods and services that they produce by more, or more frequently, than they otherwise would. And they might become more willing to grant increases in wages, because they would expect to be able to raise the prices that they charge their customers. An increase in the persistence of inflation, other things being equal, would mean that returning inflation to target would require the MPC to tighten monetary policy by more than it otherwise would.

This article discusses how a range of indicators may be used to monitor inflation expectations and price and wage-setting behaviour. The first section explains why it would be costly if inflation expectations were to become less well anchored. The second and third sections explain how various indicators can be used to assess the extent to which inflation expectations remain

Chart 1 Inflation



(1) The authors would like to thank Rashmi Harimohan for her help in producing this article.

(2) For the MPC's latest assessment of the outlook for inflation, see Section 5 of the May 2011 *Inflation Report*.

anchored by the monetary policy framework. And the fourth and fifth sections discuss various indicators that might be symptomatic of inflation expectations making inflation more persistent via changes in price and wage-setting behaviour.

At the end of each section, recent developments in these indicators are reviewed, to assess whether inflation expectations appear to have become less well anchored in the past year. The latest data suggest that long-term inflation expectations remain anchored by the monetary policy framework. And, although evidence from shorter-term inflation expectations is more mixed, there are few signs that inflation expectations have affected price or wage-setting behaviour. But the imperfect nature of data and uncertainty surrounding the metrics used, mean that the analysis below cannot indicate with certainty the extent to which inflation expectations remain anchored: the presence or absence of evidence is suggestive at best. Monitoring and assessing these indicators therefore remain a key area of focus for the MPC. An accompanying article in this edition of the *Bulletin* on pages 111–15, examines what might be learnt from movements in inflation expectations during past episodes of sustained off-target inflation across a range of inflation-targeting countries (Corder and Eckloff (2011)).

Inflation expectations and the monetary policy framework

The Bank of England's monetary policy objective is to meet the Government's inflation target.⁽¹⁾ But the policy remit recognises that, in practice, unforeseen events are likely to cause inflation to depart from the target and that attempts to prevent such movements in inflation might generate undesirable volatility in output. Consequently, the MPC sets monetary policy so that inflation will return to target in the medium term.

The MPC is able to meet its monetary policy objective more easily when inflation expectations are anchored by the monetary policy framework. If inflation expectations are anchored, in the sense that deviations of inflation from target are expected to be transitory, then companies and households are likely to set prices and wages in a way that will help to limit the extent to which any deviation in inflation persists. Conversely, if inflation expectations were to become less well anchored, deviations of inflation from target might trigger changes in price-setting and wage-setting behaviour that make those deviations more persistent. If inflation was to rise above target, that would mean that the MPC would have to tighten monetary policy by more than it otherwise would do to return inflation to target, other things being equal, which would result in a lower level of demand. The box on page 102 explains in more detail how inflation expectations may be formed and what it means for them to be anchored.

Assessing whether long-term inflation expectations remain anchored

If individuals' expectations about inflation in the long term were to become less well anchored to the inflation target, then that might become apparent in at least one of three ways. First, the level of long-term inflation expectations might move away from the target. Second, long-term inflation expectations might become more responsive to developments in the economy. And third, uncertainty about future inflation might increase. This section discusses how different indicators might point to these symptoms materialising and reviews the latest data to assess whether long-term inflation expectations have become less well anchored to the target.

The level of long-term inflation expectations

A range of data provides information about the level of inflation expected by different groups, such as households, professional forecasters and financial market participants, in the longer term. For example, surveys of households and professional forecasters ask respondents about expected inflation. And instruments traded in financial markets, such as inflation swaps or conventional and index-linked bonds, can give an indication of the long-term rate of inflation expected by financial market participants.

These different indicators have relative advantages and disadvantages for assessing whether long-term expectations remain anchored. Although the inflation expectations of households are likely to have an important influence on the extent to which the risk from inflation expectations materialises, for example because of the role they may play in wage negotiations, survey estimates are difficult to interpret. It is not clear what measure of inflation households have in mind when answering the questions.⁽²⁾ And most of the surveys have only a short backrun of data, which makes it difficult to assess what level of reported inflation expectations would be consistent with inflation being close to target in the long term. Surveys of professional forecasters might provide a more clear-cut or timely signal that inflation expectations have moved away from target, because the questions ask specifically about CPI inflation and professionals' expectations may lead those of households.⁽³⁾ But few of the measures go beyond four years ahead. Estimates of inflation expectations

(1) Subject to that, the Bank is also tasked with supporting the Government's economic objectives, including those for growth and employment. The MPC seeks to achieve its objectives by setting the level of Bank Rate and, since March 2009, by purchasing assets financed by the issuance of central bank reserves.

(2) None of the surveys of households reference a specific inflation measure. For example, the Bank/GfK NOP survey asks households what they expect to happen to 'prices in the shops generally'.

(3) For example, Carroll (2003) shows that households may use information about the forecasts of professionals in forming their inflation expectations. Surveys of professionals might also provide a more reliable indication of long-term inflation expectations than those of households, because professionals may devote more time and effort to forecasting inflation, with reputational or financial concerns giving them stronger incentives to provide a considered response.

How inflation expectations may be formed and what it means for them to be anchored

This box describes how households, companies and financial markets might form their expectations about inflation in an economy with an inflation-targeting Monetary Policy Committee (MPC), and explains what it means for inflation expectations to be anchored.

It is common in economic models to assume that individuals form expectations about future inflation using a full set of information on the state of the economy and a full knowledge of how the economy operates. Under so-called 'rational' or 'model-consistent' expectations, individuals also know the inflation target objective of the MPC and understand how it reacts to economic developments. Assuming that the MPC shares the same information and view of how the economy operates, then individuals' expectations about future inflation match the path along which the MPC chooses to return inflation to target. In that sense, expectations can be said to be 'anchored'.

In practice the costs of forming expectations in this way, such as the time and effort required to collect and process information and to understand how the economy works, are very likely to exceed the benefits of doing so for most individuals.

To avoid these costs, people may instead use simple rules of thumb to inform their expectations. There are various rules that individuals might use. For example, individuals might expect inflation to be always at target, or to remain at its current value. Individuals may also switch between using different rules, depending on how well each has performed at forecasting inflation in the past (Brazier *et al* (2008)).

There are other ways in which expectations may be formed, which lie somewhere in between 'rational' expectations and simple rules of thumb. For example, individuals might reduce the costs of forming 'rational' expectations by acquiring and processing new information only infrequently. That might mean that only a proportion of all individuals may update their information each period, as in the 'sticky information' model of Mankiw and Reis (2002). Or individuals might rely on the media to process new information, rather than doing so themselves (Carroll (2003)). Alternatively, while individuals may not have complete knowledge of how the economy works, they might learn about the state and structure of the economy from their recent experiences (Evans and Honkapohja (2001)). That could include learning about the objectives of the MPC: either its target for inflation and/or its tolerance of deviations from that target.

However they are formed, inflation expectations could be defined as being anchored if they are consistent with the MPC's inflation-targeting remit. That is to say, whatever process drives expectations, it should embody the expectation, with a reasonable degree of confidence, that inflation will return to target in the medium term and remain there.

The propensity for inflation expectations to remain anchored is likely to depend both on the way in which they are formed and on past outturns of inflation. As noted above, 'rationality' implies that inflation expectations are always anchored when the MPC pursues a remit to stabilise inflation. That is in part because its objectives, by assumption, are fully understood.

If inflation is close to target for an extended period — as it was in the first ten years of the MPC — then other, simpler, models of expectation formation are likely to deliver expectations that are anchored. For example, if individuals form expectations using a simple rule of thumb based on past inflation, it seems likely that a long sequence of inflation outturns close to target would become embedded such that inflation is always expected to return to target in the medium term.

But a persistent deviation of inflation from target might cause inflation expectations to become less well anchored. For example, if individuals use their recent experiences to learn about the objectives of the MPC, that might prompt them to change their beliefs about the MPC's ability or willingness to bring inflation back to target in the medium term, or to think that the policy committee would return inflation to target more slowly than in the past. So a persistent deviation would become embedded in inflation expectations at least until inflation returned to target. In all cases, expectations of inflation would have become less well anchored.

derived from financial market instruments are available at longer horizons. But these estimates may be influenced by factors other than inflation expectations. For example, prices may be affected by market-specific factors, such as liquidity.⁽¹⁾ And yields on nominal financial instruments will include a premium to compensate investors for uncertainty about future inflation, which may vary over time.

The responsiveness of long-term inflation expectations to news

If long-term inflation expectations were to become less well anchored to the target, they may become more responsive to developments in the economy. In an environment of well-anchored inflation expectations, long-term expectations should not respond systematically to data outturns, because those outturns have little bearing on inflation several years ahead. But if individuals question the extent to which the MPC will allow developments to have a persistent effect on inflation, then they may revise their long-term expectations in response to news about inflation and the wider economy.

Although the argument holds for any type of economic news, a simple indicator to monitor is how implied measures of inflation expectations derived from financial instruments change in response to information about contemporaneous CPI inflation (Gürkaynak *et al* (2006)).⁽²⁾ Similarly, a de-anchoring might also become evident in an increase in the responsiveness of implied measures of longer-term inflation expectations to changes in shorter-term measures. If individuals believe that developments that affect inflation in the shorter term will also have an effect on inflation in the longer term, that would tend to increase the correlation between changes in shorter-term and in long-term expectations. That said, changes in the correlation might also reflect variations in liquidity in the markets for short and long-maturity instruments.

Uncertainty about inflation in the long term

Even if central expectations of long-term inflation do not change, individuals may become less certain about how the MPC will react to current or future developments in the economy that push inflation away from target. That uncertainty might manifest itself either in greater disagreement across individuals about what inflation is likely to be in the future, or in greater uncertainty for any one individual about the range of possible outcomes.⁽³⁾

But uncertainty about future inflation may change even if long-term expectations remain anchored, because individuals may change their views about the size and persistence of shocks that are likely to affect the economy in the future. For example, following the financial crisis, individuals may believe that further shocks are more likely to occur. That re-evaluation of expected future disturbances might cause them to become

more uncertain about the prospects for inflation, even if their beliefs about the monetary policy framework do not change.

A range of indicators can be used to monitor uncertainty. Measures of dispersion of inflation expectations, such as the interquartile range, derived from surveys of households and professional forecasters, provide evidence on differences in views across individuals. The Bank of England's survey of forecasters provides evidence on the extent of individual uncertainty because it asks each forecaster to attach specific probabilities to a range of different outcomes for future inflation. Options prices, which can be used to estimate the weight that market participants collectively attach to different future inflation outturns, are likely to contain information about both: they will be influenced by the uncertainty of any one individual trading in the options market and by the variation in views between different market participants.

Have long-term inflation expectations become less well anchored recently?

Movements in most measures of longer-term inflation expectations do not appear to suggest that expectations have become less well anchored to the target in the past year (Table A). Although two of the three survey estimates of households' long-term expectations have picked up a little in that period, all three are within 1 percentage point of their historical averages. And the expectations of most professional forecasters appear to have been broadly stable around the 2% target in the past twelve months. Implied measures of long-term inflation expectations derived from financial markets have fallen in the past year: although the levels of these estimates remain somewhat higher than the 2% target, that is likely to be because these measures include a premium to compensate investors for the uncertainty surrounding future inflation.

In financial markets, there are few signs that implied measures of long-term inflation expectations have become more responsive to developments in the economy in the past year. Between 2004 and 2007, when inflation was around target on average, implied measures of long-term inflation expectations derived from gilt yields — referred to as long-term inflation breakevens — tended to respond very little to news about contemporaneous CPI on the day of publication of the data (Chart 2). And there is no evidence that a positive correlation has emerged in the most recent twelve-month period.⁽⁴⁾

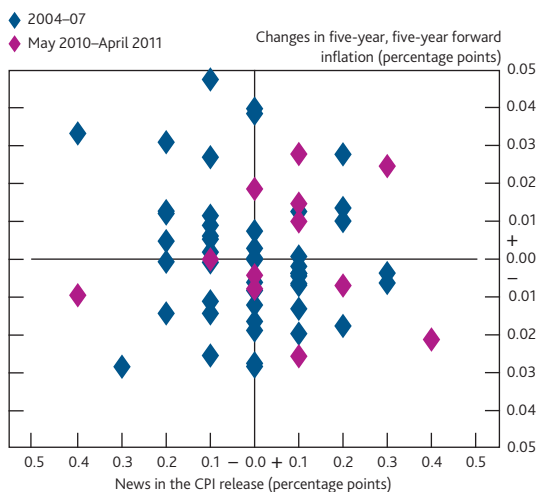
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- (1) Another market-specific factor is demand from pension funds for index-linked cash flows, which has probably pushed up estimates of inflation expectations derived from financial market instruments since 2006. For more information, see McGrath and Windle (2006).
 - (2) Financial market data are available at a daily frequency. That makes it easier to isolate the effect of news on implied measures of inflation expectations derived from financial market instruments than, say, on survey-based estimates of households' inflation expectations, which are available at a monthly frequency at best.
 - (3) For more information on how measures of uncertainty and disagreement are related, see Boero *et al* (2008).
 - (4) The results are the same when looking at the reaction of implied measures of long-term inflation expectations over two days, rather than just one, and when using measures derived from swaps, rather than gilts.

Table A Measures of expected long-term inflation

	Time horizon	Start of data	Series average (per cent)	May 2011 (unless otherwise indicated) (per cent)	Change over preceding twelve months (percentage points)
Surveys of households					
Bank/GfK NOP ^(a)	5 years	Feb. 2009	3.1	3.3	0.2
Barclays Basix ^(b)	5 years	Aug. 2008	3.8	3.0	-1.1
YouGov/Citigroup ^(c)	5–10 years	Nov. 2005	3.4	3.5	0.4
Surveys of professional forecasters					
Bank	3 years	May 2006	2.0	2.2	0.0
HM Treasury	4 years	Mar. 2006	2.1	2.1	-0.1
Consensus	5–10 years	Oct. 2004	2.2	2.5 ^(d)	0.0
Measures derived from financial instruments^(e)					
Swaps	Five-year, five-year forward	Oct. 2004	2.5	2.5	-0.2
Gilts	Five-year, five-year forward	Jan. 1985	3.3	2.7	-0.2
Memo:					
CPI		Jan. 1996	2.0	4.5 ^(d)	0.8

Sources: Bank of England, Barclays Capital, Bloomberg, Citigroup, Consensus Economics, GfK NOP, HM Treasury, ONS, YouGov and Bank calculations.

- (a) The Bank/GfK NOP survey asks households how much they expect prices in the shops generally to change, but does not reference a specific index.
 (b) The Barclays Basix survey asks households what they expect the rate of inflation to be, but does not reference a specific index.
 (c) The YouGov/Citigroup survey asks households how they expect consumer prices of goods and services to develop, but does not reference a specific index.
 (d) April 2011 data.
 (e) Financial instruments are linked to RPI inflation. The measures shown assume that market participants expect RPI inflation to be 0.8 percentage points higher than CPI inflation in the long term, around the average size of the difference over the period from 1996 to 2011. But there is considerable uncertainty over financial market participants' estimates of that difference, for example due to recent changes in the measurement of clothing and footwear prices in the CPI index. That means that actual CPI expectations may differ slightly from these figures. Change in the past year is calculated as the average in the fifteen working days to 20 May 2011 less the average in the fifteen working days to 20 May 2010.

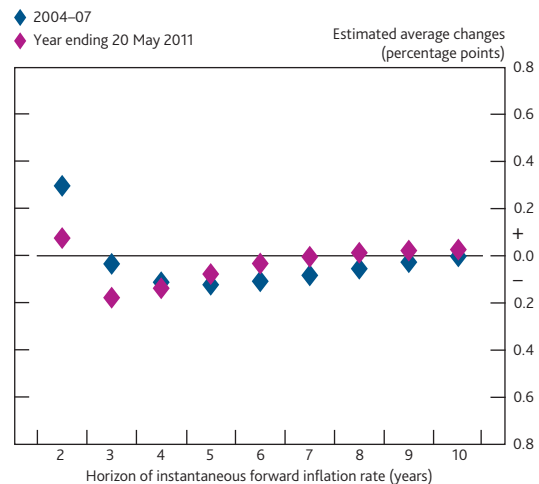
Chart 2 Changes in five-year, five-year forward inflation derived from gilt yields and news in CPI releases^{(a)(b)}

Sources: Bloomberg, ONS and Bank calculations.

- (a) Changes are measured as the change in five-year, five-year forward inflation derived from gilt yields over the day on which CPI data were published.
 (b) News in the CPI release is measured as the difference between the data outcome and the Bloomberg median forecast.

There is also little evidence that measures of longer-term inflation expectations derived from inflation swaps have tended to rise in response to increases in measures of short-term inflation expectations, either in the period between October 2004 and 2007, or in the past year (Chart 3). That

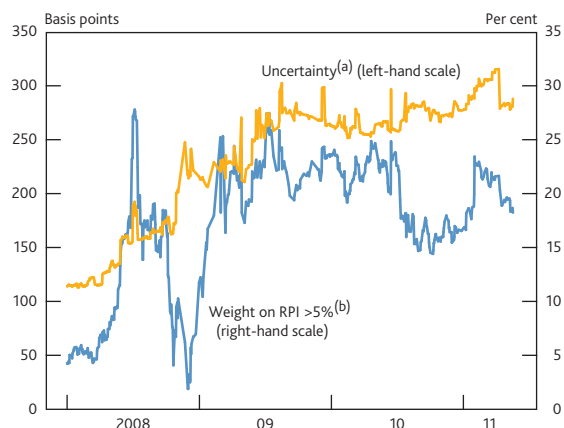
said, the absence of strong correlations cannot provide proof that responsiveness to news is unchanged, since the estimates are based on small sample sizes.

Chart 3 Estimated average changes in forward inflation rates at different horizons in response to a 1 percentage point change in the one year ahead inflation rate^(a)

Sources: Bloomberg and Bank calculations.

- (a) The average changes are estimated using the slope coefficients from regressions of daily changes in instantaneous inflation forward rates at each horizon on the daily change in the one year ahead instantaneous forward rate. The instantaneous forward rates are derived from inflation swaps.

Some indicators suggest that uncertainty about future inflation has risen, but others signal less change. Measures derived from option prices, for example, suggest that uncertainty among financial market participants has increased since the start of 2010, although it has fallen back somewhat in the past month (Chart 4). But the variation in views across households, as measured, for example, by the interquartile range of expectations recorded by the YouGov/Citigroup survey, is at broadly the same level as in 2005. Results from

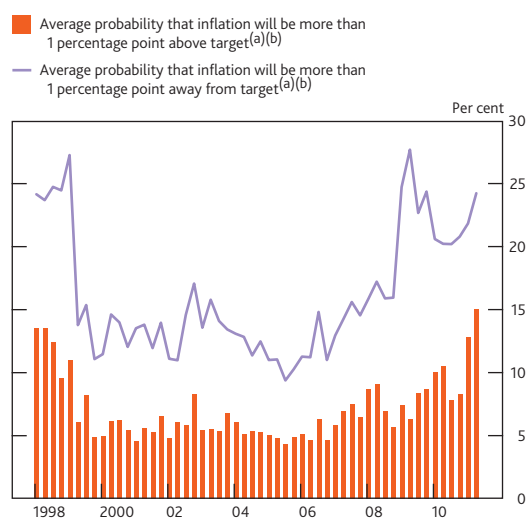
Chart 4 Uncertainty about longer-term RPI inflation outturns implied by options

Sources: Bloomberg, Royal Bank of Scotland and Bank calculations.

- (a) Standard deviation of the probability distribution of annual RPI outturns for four to five years ahead implied by options.
 (b) Probability that RPI inflation will be greater than 5% based on average probability distributions of annual RPI outturns for four to five years ahead implied by options.

the Bank's survey indicate that the average level of uncertainty across individual professional forecasters has increased (Chart 5): the probability that respondents on average attach to inflation being more than 1 percentage point away from the 2% target has been at higher levels in the past year than before the onset of the financial crisis in 2007. In addition, during the past year professional forecasters on average reported a somewhat higher probability that inflation would be more than 1 percentage point above the target in the medium term than they had done in the past.

Chart 5 Uncertainty across professional forecasters about inflation in the medium term



- (a) Calculated from the probability distributions for inflation in the medium term reported by forecasters responding to the Bank's survey. Forecasters reported probability distributions for RPIX inflation two years ahead between February 1998 and November 2003; for CPI inflation two years ahead between February 2004 and February 2006; and for CPI inflation three years ahead from May 2006 onwards.
- (b) The inflation target was changed on 10 December 2003 to 2% as measured by the annual change in the CPI from 2.5% as measured by the annual change in the RPIX.

Assessing whether shorter-term inflation expectations remain anchored

Even if long-term inflation expectations remain anchored by the monetary policy framework, temporary deviations of inflation from target may be expected to persist for longer than in the past. For example, that might occur if people were to believe that the MPC would return inflation to target more slowly than before, or if they were to expect the shocks hitting the economy to become more persistent.

This section discusses three pieces of evidence that might be symptomatic of shorter-term inflation expectations becoming less well anchored in that sense. First, a decline in the influence of the inflation target on shorter-term inflation expectations. Second, the size of movements in shorter-term inflation expectations. And third, an increase in the responsiveness of shorter-term inflation expectations to news about the economic outlook.

The influence of the inflation target on shorter-term inflation expectations

If shorter-term inflation expectations were to become less well anchored, then individuals might place less weight on the inflation target when forming their expectations. For example, individuals using simple rules of thumb to forecast inflation might switch from a rule based primarily on the inflation target to one that puts more emphasis on past inflation.

Survey data may help to assess how strong an influence the inflation target has on shorter-term inflation expectations formation. For example, the Bank/GfK NOP survey asks households whether a number of factors, including the inflation target, are an important consideration when forming their expectations of inflation in the year ahead.

Movements in shorter-term inflation expectations

The size of movements in shorter-term inflation expectations may, in some instances, provide evidence of de-anchoring. If individuals' inflation expectations were to become less well anchored, such that they expected developments in the economy to have a more persistent effect on inflation than in the past, then their shorter-term inflation expectations might change by more than is consistent with those developments.

One way to gauge whether movements in shorter-term inflation expectations can be explained by recent developments is to compare those changes with the MPC's judgement of how developments in the economy have affected the outlook for inflation in the near term. The latter will be captured by changes in the MPC's projections for CPI inflation, published each quarter in the Bank's *Inflation Report*. But such comparisons may not always be meaningful, for example because estimates of households' inflation expectations do not specifically reference CPI inflation.

An alternative method of assessing whether movements in inflation expectations appear consistent with developments in the economy is to use a statistical technique, such as a structural vector autoregression (SVAR). The SVAR approach involves estimating a set of equations where each variable is regressed on past movements of itself and the other variables in the system. Using these equations, changes in each variable can be decomposed into two sorts: those that are 'explained' by past outturns of the variables in the model; and those that are 'unexplained'.

But an SVAR estimate of the unexplained component of inflation expectations might become larger even if expectations remain anchored. SVAR models typically include only a small number of macroeconomic variables. In reality, however, inflation expectations are likely to be influenced by a much wider range of factors. That means that an SVAR model is unlikely to be able to explain some changes in inflation expectations that are driven by factors omitted from the

model. And so these movements may be captured in the estimated unexplained component.

The responsiveness of shorter-term inflation expectations to news

An increase in the responsiveness of shorter-term inflation expectations to news about the economic outlook might be indicative of expectations becoming less well anchored. If individuals were to expect deviations of inflation from target to be more persistent, then they may revise their expectations of inflation in the years ahead when they receive news about a temporary deviation of inflation from target.

As with longer-term inflation expectations, a simple indicator to monitor is how shorter-term inflation expectations respond to news about contemporaneous CPI inflation. If inflation expectations were to become less well anchored, it is likely that the correlation between changes in shorter-term expectations and CPI news would increase.

Have shorter-term inflation expectations become less well anchored recently?

Households' responses to the Bank/GfK NOP survey suggest that the inflation target remains an important influence on their one year ahead inflation expectations. Although households report that they take a wide range of factors into account when assessing the prospects for future inflation, it is not clear that the relative importance of the inflation target has fallen in the past year (Table B).

Table B Factors cited by households as important when forming their one year ahead inflation expectations^(a)

Percentage of respondents	2009	2010	2011
Inflation in the previous one to six months	86	82	88
Inflation in the previous year or before	83	83	88
Current level of interest rates	68	66	66
Current strength of the UK economy	80	77	80
Inflation target	57	57	65
Reports of inflation in the media	61	55	65
Reports of VAT in the media	49	57	69
Other	41	32	36

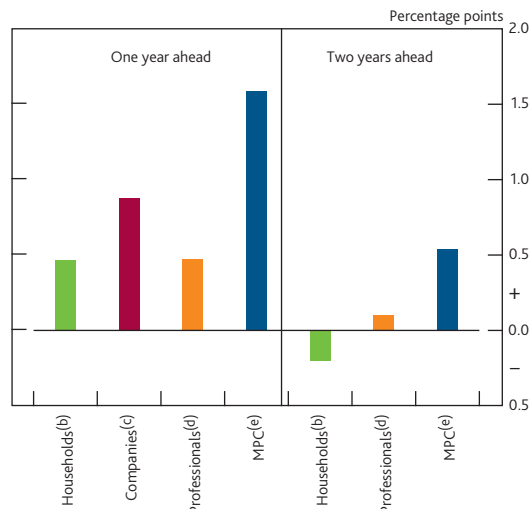
Source: Bank/GfK NOP.

(a) Respondents could select more than one option. This question is only asked in the extended February survey.

Movements in estimates of households', companies' and professional forecasters' shorter-term inflation expectations provide mixed signals about the extent to which inflation expectations remain anchored. One and two year ahead inflation expectations have increased by less than the revision to the *Inflation Report* central projection (Chart 6). But the unexplained component of two year ahead inflation expectations, estimated using an SVAR, has picked up since the start of 2009 (Chart 7): that suggests that some of the recent

increase in medium-term inflation expectations cannot be explained by the factors included in the SVAR model. And financial market implied measures of shorter-term inflation expectations appear to have become a little more responsive to news about contemporaneous CPI inflation in the past year (Chart 8). But there are large uncertainties around these estimates, as indicated by the bars in the chart.

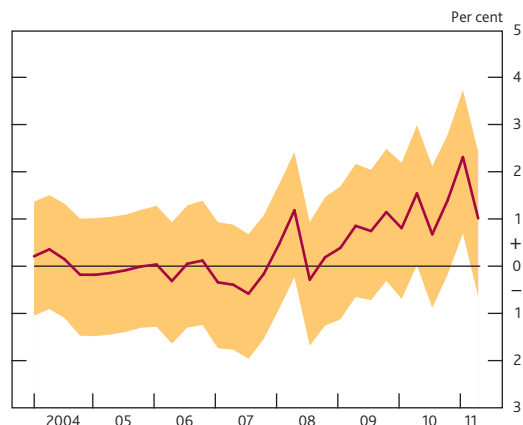
Chart 6 Changes in shorter-term inflation expectations between 2010 Q2 and 2011 Q2^(a)



Sources: Bank of England, Bank/GfK NOP, Barclays Capital, CBI (all rights reserved), Citigroup, HM Treasury, YouGov and Bank calculations.

- (a) Unless otherwise specified.
 (b) Based on an average of expectations for inflation from the Bank/GfK NOP, Barclays Basix, and, for the one year ahead measure, YouGov/Citigroup surveys. These surveys do not reference a specific price index and are based on the median estimated price change.
 (c) Based on CBI data for the manufacturing, business/consumer services and distribution sectors, weighted using nominal shares in value added. Companies are asked about the expected percentage price change over the coming twelve months in the markets in which they compete. Change is between 2010 Q2 and 2011 Q1.
 (d) Based on an average of expectations of CPI inflation from the HM Treasury and Bank of England surveys.
 (e) The MPC measure is based on modal projections under market interest rates in the May 2010 and May 2011 *Inflation Reports*.

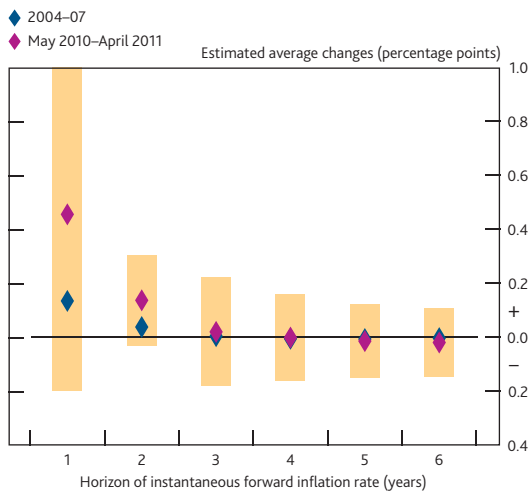
Chart 7 SVAR model estimate of the unexplained component of two year ahead inflation expectations^{(a)(b)}



Sources: Barclays Research, Bloomberg, ONS and Bank calculations.

- (a) The SVAR model includes: CPI inflation, GDP growth, Bank Rate, wages, real oil prices and two year ahead inflation expectations, measured using the Barclays Basix estimate. The model is estimated using data from 1987 Q3 to 2011 Q2. The swathe is based on estimating the 16th and 84th percentiles of the distribution around the parameters of the model (these percentiles are commonly chosen in econometric analysis).
 (b) With thanks to Alina Barnett, who carried out this analysis.

Chart 8 Estimated average changes in instantaneous forward inflation rates derived from swaps in response to CPI news^{(a)(b)(c)}



Sources: Bloomberg and Bank calculations.

- (a) The average changes are the estimated slope coefficients from regressions of the change in instantaneous forward inflation rates at each horizon on news in the CPI release, on the day on which CPI data were published.
- (b) See footnote (b) to Chart 2 for the definition of CPI news.
- (c) The bars cover two standard errors either side of the estimated slope coefficients for the past year.

Assessing changes in price-setting behaviour

If inflation expectations were to become less well anchored, that might lead to changes in price-setting behaviour that cause inflation to be more persistently away from target. For example, if companies were to believe that inflation would remain above target for longer, then they may raise their own prices for the goods and services that they produce by more, or more frequently, than they otherwise would. And, if they were to expect other businesses to raise prices too, their expectations of general price inflation might also rise.

Indicators of companies' general price inflation expectations and their pricing intentions are limited. Surveys of businesses, such as those conducted by the BCC and the CBI, are the main source of evidence. But these provide little information about the extent to which companies' inflation expectations are consistent with inflation being close to target in the longer term, since the survey questions ask how prices are expected to change in the coming quarter or year only.

The rate of inflation among goods and services for which prices typically change infrequently might provide an indirect signal of companies' inflation expectations. Not all companies change their prices at the same frequency. Businesses in sectors that experience frequent changes in input costs and face few costs in changing advertised prices, such as supermarkets, might change their prices regularly. Businesses in sectors that face large costs in changing prices, however, might change their prices only once in a while.⁽¹⁾ If a company can change its price only infrequently, then the best price to set will depend on the range of price and demand conditions

that the company expects to face during the period in which it is unable to change its price. Monetary policy will affect both price and demand conditions. So if people were to doubt the MPC's willingness or ability to return inflation to target, then companies that can change their prices only infrequently may raise their prices by more, or more frequently, than they otherwise would. That means that changes in the prices of these 'sticky price' goods and services might provide some information about companies' expectations of future inflation and their beliefs about monetary policy more generally.⁽²⁾

But it is difficult to interpret these pieces of evidence without taking into account other factors that influence prices. Changes in these factors, such as input costs, are likely to cause companies' own price and general price inflation expectations to move in tandem. For example, when imported input costs rose following the depreciation of sterling, companies might have expected to pass on some of the increase in their costs into their own prices; and they might have expected the prices charged by other businesses to rise too, as they did the same. That makes it difficult to assess whether changes in companies' pricing intentions reflect changes in their general price inflation expectations or a separate factor.

Recent developments in price-setting behaviour

Survey estimates of companies' expectations of inflation in the very short term have risen in the past year or so, but that could reflect increases in input costs. The net percentage balance of companies expecting their own prices to go up in the next three months in 2011 Q1 was above its average between 1997 Q2 and 2007 Q4 (Table C). But a greater-than-average percentage of businesses also reported that they were facing pressure to raise prices from material prices.

Table C Companies' pricing intentions in the next three months and current pay pressures

	Averages			
	1997 Q2–2007 Q4	2009	2010	2011 Q1
Net percentage balance expecting prices to rise in the next three months	21	7	23	34
Percentage reporting pressure to raise prices from material prices	28	32	39	47
Percentage reporting pressure to raise prices from pay settlements	28	17	20	23

Sources: BCC, ONS and Bank calculations.

- (1) For more information about companies' pricing decisions, see Greenslade and Parker (2008) and Bunn and Ellis (2009).
- (2) For more information about this method for extracting a signal about companies' inflation expectations, see Bryan and Meyer (2010).

More forward-looking indicators provide few signs that price-setting behaviour has changed in the past year. Companies reported in 2011 Q1 that they were expecting their own prices and the general level of prices to rise only modestly in the next twelve months (**Chart 9**). And, over the past few years, the average rate of inflation among sticky price goods and services has been broadly stable at about 2%, its average level since 1997 (**Chart 10**). That may indicate that companies do not expect inflation to remain above target and that they are setting their prices accordingly.

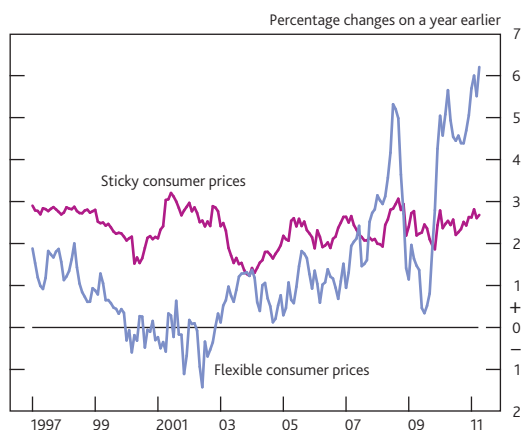
Chart 9 Companies' expected changes to prices



Sources: CBI and ONS.

- (a) Companies are asked: 'What percentage change is expected to occur over the next twelve months in your own average output price for goods sold into UK markets?'.
 (b) Companies are asked: 'What percentage change is expected to occur over the next twelve months in the general level of prices in the markets that you compete in?'.

Chart 10 Inflation in sticky and flexible price sectors^{(a)(b)}



Sources: ONS and Bank calculations.

- (a) The CPI basket is divided into twelve subcomponents, based on the classification of individual consumption according to purpose categories. These twelve subcomponents were divided between flexible and sticky price sectors based on the frequency at which the prices of different types of goods and services change. These frequencies were calculated from the price quotes that underpin the monthly CPI, which the ONS makes available to researchers via its secure Virtual Microdata Laboratory (described in Ritchie (2008)). The flexible price sector comprises those components of the basket which change more regularly than the median frequency and the sticky price sector comprises those components of the CPI basket in which prices change less often than the median frequency. The sticky price series excludes utility prices, which are more likely to be changed due to changes in gas and other commodity prices rather than developments in the wider economy.
 (b) With thanks to Philip Bunn and Colin Ellis for their help with this analysis.

Assessing changes in wage-setting behaviour

Inflation expectations may affect the persistence of inflation via changes in wages. That might occur directly through wage negotiations. For example, if employees were to expect inflation to remain above target, they may demand higher pay to compensate for the reduced amount of goods and services that they would be able to purchase with their current wages. That would put pressure on companies to raise prices. Alternatively, a rise in wage inflation might be preceded by a change in price-setting behaviour: companies might become more willing to pay higher wages if they were to expect above-target inflation to persist, because they would expect to raise the prices that they charge their customers. Increases in wages would also be likely to put upward pressure on inflation by raising spending.

But other factors are also likely to influence wages. Companies may pay higher wages if their employees become more productive. Or a fall in unemployment might push up wages, because it decreases the pool of individuals whom employers could look to use in place of their current employees. It is not straightforward to judge how large an effect these factors have on wages and so estimate the influence of inflation expectations on wage growth.

Surveys of companies and households may help to isolate the effect of changes in inflation expectations on wages. For example, the BCC surveys ask companies whether they are currently suffering pressure to raise prices from pay settlements. And the February 2011 Bank/GfK NOP survey included an additional question that asked households whether they were looking, or planning to look, to increase pay with their current employer in light of their inflation expectations.⁽¹⁾

Surveys might also indicate if companies are more likely to increase wages because they expect above-target inflation to persist. Since 2008 Q2, the CBI surveys have asked companies how they expect wage costs per employee to change over the next twelve months, in addition to asking about expected changes in prices. If companies were to become more willing to pay higher wages because they expected to raise the prices they charged customers, then it is likely that they would revise up both their expectation of changes in their own prices and their expectations of changes in wage costs, all other things constant. That would tend to generate a positive correlation between changes in own price inflation expectations and changes in wage cost inflation expectations across companies responding to the CBI surveys.

(1) Respondents were also asked if they were taking, or planning to take other actions, such as looking to increase pay in other ways and shopping around for better value.

Recent developments in wage-setting behaviour

Recent data provide little evidence that inflation expectations are feeding through into wages. Current wage growth remains around 2%, some way below its pre-recession average rate (Table D). And growth in unit labour costs, which may be a more relevant measure for companies' pricing decisions, weakened throughout 2010, in part reflecting some recovery in productivity.⁽¹⁾ But it is difficult to judge precisely the extent to which other factors, such as the rise in unemployment during the recession, has pushed down current wage growth and so what offsetting effect inflation expectations may have had.

Table D Alternative estimates of annual pay growth

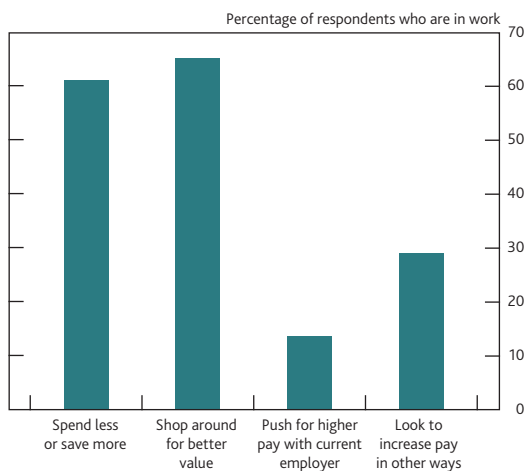
	Averages ^(a)		2010				2011
	1997–2007	2009	Q1	Q2	Q3	Q4	Q1
Pay settlements ^(b)	3.3	2.5	1.6	1.6	1.6	1.6	1.7
AWE regular pay ^(c)	4.0	1.7	1.8	1.3	2.2	2.3	2.1
Unit labour costs	2.6	5.9	4.5	1.4	1.2	0.9	n.a.

Sources: Bank of England, Incomes Data Services, the Labour Research Department, ONS and XperTHR.

- (a) Unless otherwise stated.
- (b) Average over the past twelve months, based on monthly data (per cent).
- (c) Average weekly earnings. Average since 2001.

There are few signs that households are pushing for higher pay in response to higher inflation expectations. Of those working households that responded to the February 2011 Bank/GfK NOP survey, only a small percentage indicated that they were looking to increase pay with their current employer⁽²⁾ (Chart 11). Consistent with that, the percentage of companies reporting that they were facing significant pressure to raise prices on account of pay in 2011 Q1 was below its average during the period between 1997 Q2 and 2007 (Table C).

Chart 11 Working households' planned actions in light of their short-term inflation expectations^(a)



Source: Bank/GfK NOP survey.

- (a) Respondents to the February 2011 Bank/GfK NOP survey were asked which, if any, from a list of actions they are taking, or planning to take, in light of their expectations of price changes over the next twelve months. The list included four actions in addition to those shown on the chart: bring forward major purchases; move savings out of banks or building societies into other assets such as shares, bonds, housing or gold; other (unspecified); and take no action. Respondents could select up to three actions.

Companies do not appear to have become more willing to grant higher wages at the same time as raising prices in recent months. Changes in individual companies' wage inflation expectations have tended to be only weakly related to changes in their price inflation expectations in the past couple of years and there are few signs that those correlations have increased in the most recent survey (Table E).

Table E Correlations between changes in companies' wage inflation expectations and their price inflation expectations

	2008 Q2–2010 Q4	2011 Q1
Own prices	0.18	0.18
General level of prices	0.20	0.20

Sources: CBI (all rights reserved) and Bank calculations.

Conclusion

A persistent deviation of inflation from target might cause inflation expectations to become less well anchored by the monetary policy framework. For example, individuals might question whether the MPC remained willing or able to return inflation to the target in the medium term. Or, perhaps more likely, individuals might think that the MPC had become more tolerant of deviations of inflation from target and, therefore, would expect inflation to return to target more slowly, even though their long-term expectations remained anchored.

If inflation expectations were to become less well anchored, then deviations of inflation from target might trigger changes in price-setting, wage-setting and spending behaviour that make inflation more persistent. That would, other things being equal, require the MPC to tighten monetary policy by more than it otherwise would in order to return inflation to target.

The indicators discussed above suggest that long-term inflation expectations remain anchored by the monetary policy framework. And, although evidence from shorter-term inflation expectations is more mixed, there is little evidence that they have become significantly de-anchored. Moreover, there are few signs that inflation expectations have affected price or wage-setting behaviour.

But the imperfect nature of data means that there are large uncertainties around all of these indicators, which caution against concluding with confidence that inflation expectations remain anchored to the target. The MPC continues to monitor the indicators set out in this framework closely, and remains alert to other pieces of evidence that might indicate that the risk to inflation from inflation expectations is materialising.

- (1) For more detail on recent developments in pay, see Section 4.3 of the May 2011 *Inflation Report*.
- (2) That may underestimate the proportion of employees for whom an increase in inflation expectations is leading to higher pay demands, since some employees are covered by collective bargaining agreements.

References

Bank of England (2011), *Inflation Report*, May.

Boero, B, Smith, J and Wallis, K (2008), 'Uncertainty and disagreement in economic prediction: the Bank of England survey of external forecasters', *The Economic Journal*, July, Vol. 118, Issue 530, pages 1,107–27.

Brazier, A, Harrison, R, King, M and Yates, T (2008), 'The danger of inflating expectations of macroeconomic stability: heuristic switching in an overlapping-generations monetary model', *International Journal of Central Banking*, June, pages 219–54.

Bryan, M and Meyer, B (2010), 'Are some prices in the CPI more forward looking than others? We think so', *Federal Reserve Bank of Cleveland Economic Commentary no. 2010/2*.

Bunn, P and Ellis, C (2009), 'Price-setting behaviour in the United Kingdom: a microdata approach', *Bank of England Quarterly Bulletin*, Vol. 49, No. 1, pages 28–36.

Carroll, C D (2003), 'Macroeconomic expectations of households and professional forecasters', *The Quarterly Journal of Economics*, Vol. 118, No. 1, pages 269–98.

Corder, M and Eckloff, D (2011), 'International evidence on inflation expectations during Sustained Off-Target Inflation episodes', *Bank of England Quarterly Bulletin*, Vol. 51, No. 2, pages 111–15.

Evans, G and Honkapohja, S (2001), *Learning and expectations in macroeconomics*, Princeton University Press.

Greenslade, J and Parker, M (2008), 'Price-setting behaviour in the United Kingdom', *Bank of England Quarterly Bulletin*, Vol. 48, No. 4, pages 404–15.

Gürkaynak, R, Levin, A and Swanson, E (2006), 'Does inflation targeting anchor long-run inflation expectations? Evidence from long-term bond yields in the US, UK and Sweden', *Federal Reserve Bank of San Francisco Working Paper no. 2006-09*.

Mankiw, N G and Reis, R (2002), 'Sticky information versus sticky prices: a proposal to replace the New Keynesian Phillips Curve', *Quarterly Journal of Economics*, Vol. 117, No. 4, pages 1,295–328.

McGrath, G and Windle, R (2006), 'Recent developments in sterling inflation-linked markets', *Bank of England Quarterly Bulletin*, Vol. 46, No. 4, pages 386–96.

Ritchie, F (2008), 'Secure access to confidential microdata: four years of the Virtual Microdata Laboratory', *Economic and Labour Market Review*, Vol. 2, No. 5, May.