Trends in UK labour supply

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- The path of labour supply is a key consideration for the Monetary Policy Committee (MPC). It helps to determine the overall supply capacity of the economy and therefore the amount of output that can be produced without generating excess inflationary pressure.
- Labour supply appears to have grown robustly since the financial crisis, as a greater number of people have retired later and more part-time workers have sought full-time jobs.
- Nevertheless, the recovery in the demand for labour has led to a significant erosion of labour market slack in recent years, as unemployment, labour market participation and average hours worked have all moved back towards their equilibrium levels.

Overview

Labour supply has an important bearing on monetary policy as it helps to determine how quickly the economy can grow without generating inflationary pressure. Total hours worked fell sharply relative to the supply of labour following the financial crisis (see **summary chart**), leading to a substantial build-up of slack in the labour market as people became unemployed or underemployed. The demand for labour rebounded subsequently, but labour supply also appears to have grown robustly in recent years, suggesting that a margin of slack probably still remains in the labour market.

This article provides more detail on some of the analysis that has fed in to the MPC's recent assessments of the supply side of the economy. It explains how, besides population growth, labour supply depends on the proportion of people wanting to work — the **participation rate**, the **unemployment rate**, and the **average number of hours** that people work.

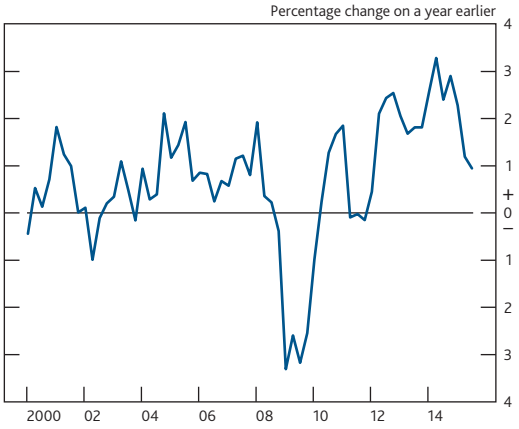
Taking these elements of labour supply in turn, participation in the labour market has remained strong in recent years, despite the influence of an ageing population, as people have worked longer, at least in part reflecting increased life expectancy. Following the financial crisis, both younger and older people appear to have become discouraged from seeking work, but this cyclical effect seems to have since unwound.

Much of the substantial increase in unemployment following the crisis has since unwound as well. But the precise level at which the unemployment rate is likely to settle — the 'equilibrium' unemployment rate — is unclear. On the one hand, given that the unemployment rate has not returned to its pre-crisis average despite the strong pickup in the demand for labour, it could be argued that the equilibrium unemployment rate has increased slightly. On the other hand, the persistent weakness of wage growth in 2013 and 2014, despite the falls in unemployment, might point to a larger drag from slack, which could imply a lower equilibrium unemployment rate.

The number of hours people report that they want to work has increased in recent years. Signs of underemployment persist, with an unusually high number of part-time workers wishing to move to a full-time job, for example.

Overall, this 'bottom-up' approach suggests that a modest amount of slack remains, concentrated in average hours worked. Alternative, 'top-down', estimates of slack based on statistical filtering techniques using information on the path of output and other cyclical indicators also point to a small margin of slack remaining.

Summary chart Four-quarter growth in total hours worked



Introduction

The inflation outlook depends in part on the level of aggregate demand relative to the economy's capacity to produce goods and services. The presence of spare capacity, or slack, is likely to reduce price pressures whereas very intensive use of productive capacity is likely to increase them. The evolution of the supply capacity of the economy, therefore, determines how quickly the economy can grow without generating inflationary pressure.

The supply capacity of the economy depends on the resources available to produce goods and services, and how efficiently those resources are used. One important component of aggregate supply within an economy, therefore, is the amount of labour that is available. As the number of people available to work increases, for example due to growth in the population or changes in people's desire to work, the economy is able to produce more goods and services. The extent to which that labour is utilised will depend on the hiring plans of companies. When demand for a company's products is strong they are likely to employ more people, whereas in a period of weak demand they are likely to reduce hiring or lay off workers, or cut their hours, leading to greater labour market slack.

The more slack there is in the labour market, the lower are likely to be wage pressures, and therefore inflation. The opposite will be true when the labour market is particularly 'tight'. So the balance between the demand for labour and its supply is an important issue for monetary policy.

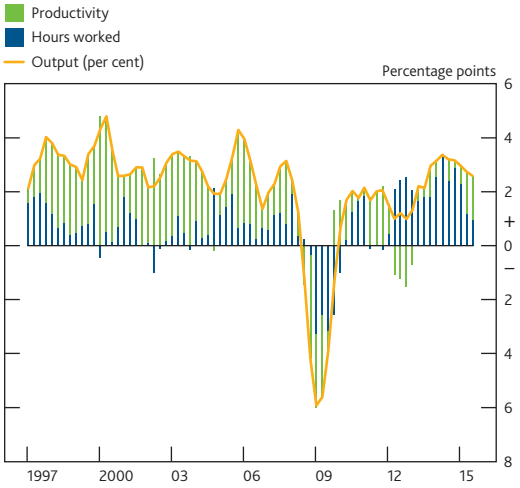
The May 2015 *Inflation Report* set out the views of the Monetary Policy Committee (MPC) on the outlook for labour supply, and this assessment has underpinned its subsequent forecasts.(1) This article provides more detail on the recent trends in labour supply that have informed the Committee's recent assumptions on labour supply, and their implications for the degree of slack in the labour market.

The first section of this article looks at the evolution of labour supply in recent years and its role in facilitating increases in output. The second section sets out the different ways in which the supply of labour can vary. The third section looks at the recent trends in each of the components of labour supply in more detail, looking in particular at their evolution since the financial crisis. The fourth section briefly considers alternative ways of assessing the balance between demand and supply in the economy, and the fifth concludes.

The role of labour in output growth since the financial crisis

In normal times, much of the growth in output in the United Kingdom has been facilitated by improvements in productivity — the efficiency with which inputs can be combined to produce goods and services. Increases in labour supply have typically played a smaller role. In the decade leading up to the financial crisis, UK GDP growth averaged just under 3% a year. On average, around three quarters of that could be accounted for by productivity growth (including the effect of growth in the capital stock) measured as output per hour worked, with the rest coming from labour supply (**Chart 1**).

Chart 1 Contributions to four-quarter UK GDP growth(a)



Sources: ONS and Bank calculations.

(a) The output series is based on the MPC's best collective judgement about the final estimate of GDP, and the hours worked series is based on population data that have been adjusted for expected revisions to ONS Labour Force Survey estimates to incorporate the latest data on net migration.

The picture has been quite different since the financial crisis. Output fell sharply in 2008 and 2009. Part of that was accounted for by a fall in the total number of hours worked, as people lost their jobs and unemployment rose, but there was also a substantial fall in productivity. Since then, output growth has recovered, but that has been associated mostly with an increase in the use of labour. GDP growth averaged around 2¼% a year between 2010 and 2014, and around four fifths of that was accounted for by increases in the number of hours worked (**Chart 1**).

The increased use of labour to deliver increases in output has been associated with sharp falls in unemployment. And its counterpart has been persistent weakness in productivity growth, whose causes have been the subject of a considerable amount of analytical work.(2) As labour market slack is used up, it is likely that further sustained growth in output will require a recovery in productivity growth towards more normal rates.

(1) See the 'Output and supply' section of the May 2015 *Inflation Report* (pages 22–32); www.bankofengland.co.uk/publications/Documents/inflationreport/2015/may3.pdf.
(2) See Barnett, A, Batten, S, Chiu, A, Franklin, J and Sebastiá-Barriel, M (2014), 'The UK productivity puzzle', *Bank of England Quarterly Bulletin*, Vol. 54, No. 2, pages 114–28; www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q201.pdf.

The outlook for both growth and inflation will depend in part, therefore, on trends in labour supply and on how much spare capacity remains in the labour market. There are signs that labour supply has grown rapidly in recent years. That has allowed the total number of hours worked to increase while still leaving some slack in the labour market. Decomposing movements in the labour market into different components can help in assessing the likely future path of labour supply and the amount of slack remaining in the labour market.

The components of labour supply

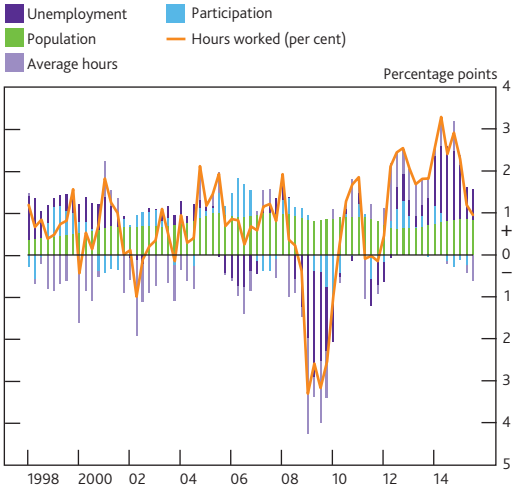
One standard measure of the overall amount of labour employed in the economy is the total number of hours worked (which is the measure used in the section above). In an accounting sense, there are four factors that determine how many hours are worked across the economy in aggregate. First, the number of hours worked will depend on the size of the population. Second, only a subset of the population will want to work. The proportion of the working-age population that wants to work (and is either employed or actively looking for work) is called the participation rate. Third, of those that want to work, there will always be some people who are unemployed at any given moment, for example as they move from one job to another. And finally, the number of hours worked by those in employment can vary.

As **Chart 2** highlights, in the pre-crisis period, population growth accounted, on average, for all of the increase in total hours worked, with a trend increase in participation offset by a trend decline in average hours worked. The number of people aged 16 and over rose fairly steadily at an average rate of 0.7% per year during the period 1997–2008, the same as the average growth of total hours worked over that period. As the financial crisis hit, the fall in total hours worked reflected a rise in the unemployment rate as well as a decline in both the participation rate and the average hours worked by those in employment. The recovery in the labour market has seen all of those effects unwind over time.

The implications of such movements in total hours worked depend on the underlying trend for labour supply. Inflationary pressure depends in part on the degree of slack in the labour market, which can be thought of as reflecting the gap between the current number of hours worked and their trend, or equilibrium, level. The latter refers to the amount of labour that could be supplied without exerting excessive upward or downward pressure on wage growth and inflation. It can be affected by a wide range of factors, such as demographics, employment law and the tax and benefit system.

Changes in trend labour supply can come from any of its components. For example, the population may grow more rapidly due to a sustained increase in inward migration, or an increase in retirement ages could mean more people seeking

Chart 2 Contributions to four-quarter growth in total hours worked



to work. Moreover, those people already in employment can vary the number of hours they want to work. If part-time workers would like to work full-time, for example, there is scope for total hours worked in the economy to increase. These decisions on different components of labour supply can also be linked. For example, within a household of two or more people, the decision to supply more labour could take the form of either an additional person looking for work, which would affect the participation rate, or an existing worker looking to move from a part-time job to a full-time one, which would affect average hours.

The degree of slack in the labour market, therefore, can be decomposed into the gaps between the **participation rate**, the **unemployment rate** and **average hours worked** and their respective trends. Such a disaggregated approach can often reveal richer stories about developments in the labour market.

The next section looks at each of the components of the labour market in turn, to assess how the underlying trends are likely to have evolved and what that implies for the degree of slack in the labour market.

Recent movements in trend labour supply

The trend or equilibrium for labour supply cannot be observed directly, making it difficult to judge the degree of slack. But it is possible to draw inferences based on other indicators, economic theory, and the relationship between labour market quantities and other variables such as wages.

The main focus of this section is to assess recent trends in labour supply, and what these imply for how much slack there might still be in the labour market. But it also considers how trends in labour supply might evolve in the future, as this will help to determine how quickly the economy can grow in the future without generating inflationary pressure. The evidence

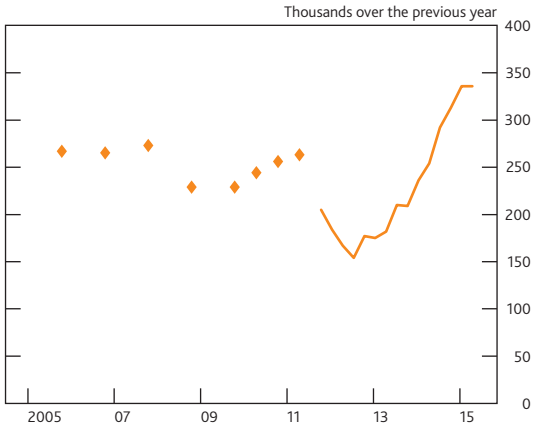
across the different components is brought together at the end of this section to consider the likely evolution of overall slack in the labour market. Subsequent sections then look at alternative estimates of aggregate slack. In the November 2015 *Inflation Report*, the Monetary Policy Committee's best collective judgement was that spare capacity of around ½% of GDP remained, but it also noted that there was a wide degree of uncertainty around that estimate and a range of views on the Committee.

Population

Population growth is an important component of the evolution of labour supply and will help to determine how quickly output can grow without generating inflationary pressure. The population measure of most interest for monetary policy is the number of people aged 16 and over as that represents the overall potential workforce. Growth in the 16+ population tends to be relatively smooth, although it can be affected by periods where the birth rate was unusually high or low: the 'baby boom' generation born following the Second World War, for instance, boosted the workforce significantly once they entered adulthood.

Over the past decade, population growth has also been boosted by an increase in net migration into the United Kingdom. While net inward migration eased following the financial crisis, it has picked up again over the past couple of years, reaching 336,000 in the year to 2015 Q2 (**Chart 3**), equivalent to around ½% of the UK population. It is difficult to know how migration flows, and hence overall population growth, are likely to evolve in future, but in recent *Inflation Report* projections, the MPC has assumed that migration will gradually fall back towards its average over the past decade.

Chart 3 Net long-term inward migration[a]



(a) The data in the chart refer to flows over the preceding year. Prior to 2012 the data were only collected every six months or annually, rather than quarterly.

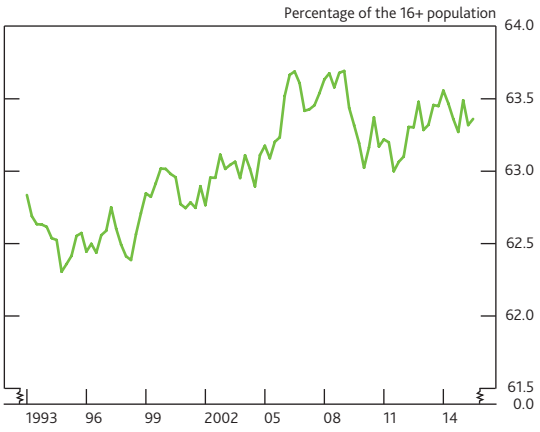
The impact of migration on labour supply will depend on the characteristics of those arriving in the United Kingdom. The recent pickup in net inward migration largely represented people arriving having already secured a job or looking for work, consistent with a cyclical response of net migration to changes in relative job prospects in the United Kingdom and abroad. These migrants are likely, therefore, to boost the number of people flowing into the labour market and hence labour supply.

Overall, the population of people aged 16 and over has increased by around 0.8% per year, on average, over the past five years. That growth is expected to slow to an average of around 0.7% per year over the next few years.

Participation in the labour market

The proportion of the adult population willing and able to work also contributes to the overall supply of labour in the economy. Structural changes in the labour market can lead to persistent changes in the degree of participation. For example, the participation rate rose gradually between the mid-1990s and 2008, reflecting increases in female participation and in the number of people retiring later (**Chart 4**). But participation can also vary with economic conditions. For example, there may be less incentive for some people to look for work when unemployment is high and job prospects are poor, so they may choose to 'leave' the labour market — that is, cease to look actively for work — at least temporarily. Those people may nevertheless choose to return to work as job prospects improve. These cyclical fluctuations do not affect what we would think of as the 'trend' participation rate. Rather, the difference between actual and trend participation can be thought of as the 'participation gap', which represents slack in the labour market. The challenge is to judge which movements in participation are long-lasting structural ones, and which are cyclical.

Chart 4 The participation rate



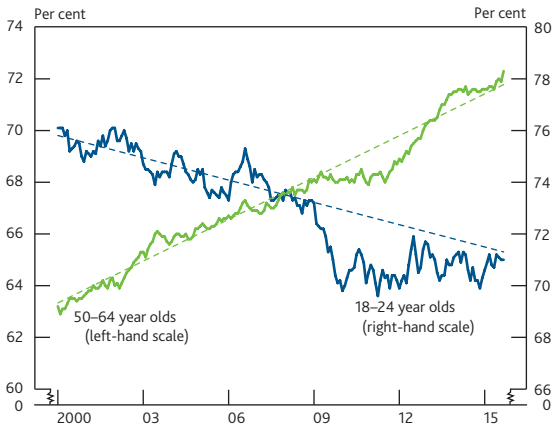
The cyclical response of participation to the financial crisis

Between 2008 Q2 and 2010 Q1 the participation rate fell by nearly ¾ of a percentage point to a trough of 63%, a significant fall equivalent to around 325,000 fewer people participating in the labour market. The rate has since

recovered somewhat. Changes in participation rates for different age groups suggest that those movements are likely to have reflected cyclical factors. The initial decline mainly reflected falls in participation among the young (18–24 years old) and older age groups (50–64 years old).

The fall in participation among the young would be consistent with people staying in education for longer in the face of high unemployment. The number of students increased sharply over that period. Participation within the 18–24 year old age group had been on a downward trend prior to the crisis, as the proportion of students in that group increased, but the fall in 2008 and 2009 was much more marked (**Chart 5**). In addition, some older people may have retired early in response to the deterioration in labour market conditions. There had been an upward trend in participation among 50–64 year olds prior to the crisis, but the participation rate flattened off subsequently for a period.

Chart 5 Participation rates for 18–24 and 50–64 year olds(a)



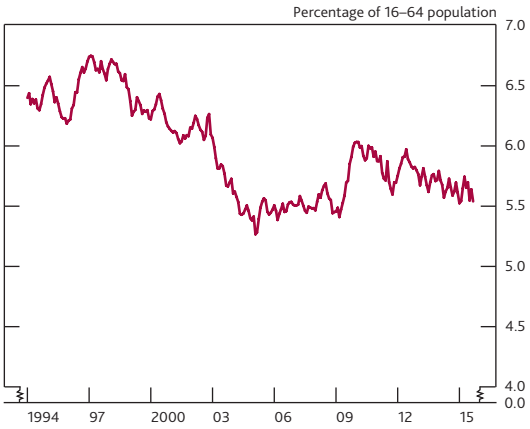
Sources: ONS and Bank calculations.

(a) The dashed lines indicate 2000–08 trends in the age-specific participation rates, extended into later years.

More recently, these deviations of participation rates relative to their pre-crisis trends have unwound for both age groups, consistent with the cyclical effects largely dissipating as labour market conditions improved. On the face of it, that suggests that there is relatively little slack remaining in the labour market as a result of cyclically low participation.

Another way to judge the participation gap is to look at the number of people that are not participating in the labour market but nevertheless say that they would like a job. These people can be seen as 'discouraged' workers given that they want to work in principle, but are not actively seeking a job. The proportion of such people in the Labour Force Survey (LFS) picked up sharply in 2009, consistent with a cyclical reduction in participation (**Chart 6**). Since then it has gradually fallen back to close to its pre-crisis level, consistent with a reduction in labour market slack.

Chart 6 'Discouraged' workers: people that want a job but are inactive in the labour market



The indicators discussed above suggest that the participation gap is currently quite small. Given that the actual participation rate is currently close to its pre-crisis level, that would also imply that the trend, or equilibrium, participation rate has been fairly flat since the crisis. So another way of assessing whether the participation gap is small is to consider whether a fairly flat trend over the past few years is plausible, which is discussed next.

Assessing the recent path of trend participation

Other things being equal, demographic effects would probably have led to a fall in participation over the past few years. Older age groups tend to have lower participation rates as they reach retirement age — the rate is just over 10% for those aged 65+ and 72% for 50–64 year olds, compared with 86% for the 35–49 age group. So it seemed likely that the proportion of the 16+ population working, or looking for work, would decline as the baby-boom generation started to reach retirement age. The proportion of the adult population aged 50 and over has increased from 42% to 45% over the past five years. But, in the event, that has been offset by the fact that many of them have retired later than previous generations. As a result, the participation rates for those aged over 50 have increased substantially in recent years (**Chart 7**). That would point to a flatter trend for participation than the fall that might have been expected given the ageing of the population.

An attempt can be made to calibrate the effect of this and other factors driving the longer-term trend in the participation rate. Using disaggregated data on participation rates by age and year of birth, it is possible to construct a 'cohort model' that estimates the impact of factors such as life expectancy, demographics, health status, and education levels as well as cyclical factors such as unemployment and asset prices on participation rates for different generations, or cohorts, over their lifetimes.(1) By tracking those cohorts over time,

(1) The model uses LFS microdata and is similar to that used in Aaronson, D, Davis, J and Hu, L (2012), 'Explaining the decline in the U.S. labor force participation rate', Federal Reserve Bank of Chicago, *Chicago Fed Letter No. 296*, March.

Chart 7 Cumulative changes in participation rates since 1993 for different age groups

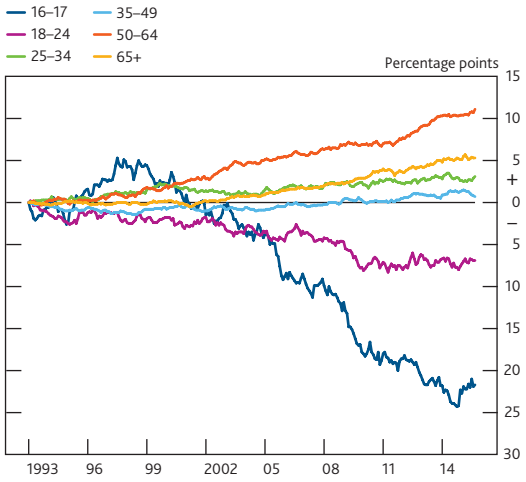
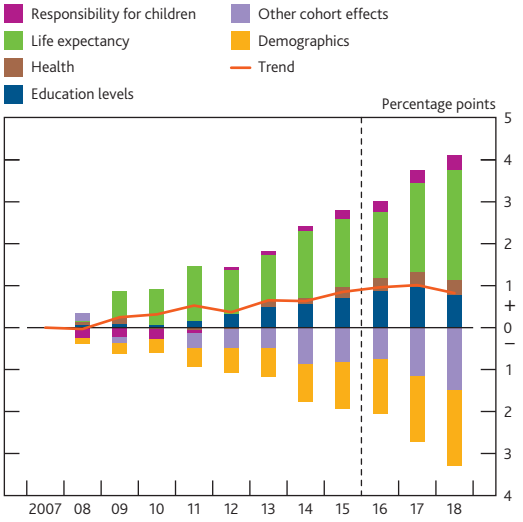


Chart 8 Contributions to estimated trend participation since 2007[a]



Sources: ONS and Bank calculations.

(a) The chart shows the contribution of various structural factors to the change in the aggregate participation rate since 2007 based on the estimated impact of these factors on different age groups, and changes in the age mix of the population over time.

alongside movements in the factors mentioned above, it is possible to model the evolution of participation. And by stripping out the estimated effects of the cyclical factors it is possible to get an estimate of the trend for participation.

The estimated effects of the various drivers of trend participation since 2007 are shown in **Chart 8**. Taking all of those effects together, the model would suggest a flat to slightly rising trend up to 2015, as shown by the orange line. There has indeed been a drag from the ageing population, but it has been offset by increases in life expectancy in particular. As life expectancy has increased, people have tended to work for longer, perhaps encouraged by concerns over the adequacy of pension savings, and also by greater opportunities for less physical work. Greater educational attainment is typically associated with higher participation rates, and so the continued shift towards a more highly educated population is also estimated to have pushed up trend participation. Overall, a relatively flat trend over the past few years is consistent with the other evidence presented in this section, suggesting that there is probably little slack remaining from the cyclical reduction in the participation rate following the financial crisis. Over the next few years, a further drag from the ageing population is likely to continue to be offset by increasing life expectancy and rising education levels, suggesting a trend for the participation rate that continues to be fairly flat. Those upward pressures on participation are likely to be reinforced by structural changes such as increases in the state pension age. Given the scale of the forces pushing in both directions, however, there is considerable uncertainty about the likely trend for the participation rate.

Overall, this analysis suggests that the participation gap is small. The flat trend for participation over the past few years that this implies can be explained by the offsetting effects of the ageing population and increased life expectancy leading to people working for longer.

Unemployment

The unemployment rate is the most well-known indicator of slack in the labour market. There will always be people that are unemployed at a given point in time as it takes time for people to find the right job. This is sometimes referred to as frictional unemployment, and represents the long-run equilibrium level of unemployment. But unemployment varies for cyclical reasons as well, for example as weak labour demand leads to an increase in lay-offs and less hiring. The difference between actual unemployment and estimates of its equilibrium value is sometimes referred to as the 'unemployment gap' and provides an indication of the degree of slack implied by the current unemployment rate.

The LFS unemployment rate was relatively stable between 2001 and the financial crisis at around 5% (**Chart 9**). It picked up sharply in 2008 and 2009 as the recession hit. Over the past two years it has fallen back again towards its pre-crisis level as the demand for labour recovered, and there are reports of some skill shortages. The unemployment gap appears to have diminished substantially over that period, therefore, but estimating how big it is requires an estimate of the equilibrium rate.

A distinction can be made between the equilibrium rate of unemployment in the medium and long run. The long-run equilibrium is the rate at which unemployment might be expected to settle once all of the effects of shocks to the economy have faded away. The economy might only reach this equilibrium after a long time. The medium-term equilibrium captures the idea that over the shorter time spans relevant for monetary policy — of, say, a few years — persistently high unemployment can, for a period, itself affect

Chart 9 The unemployment rate

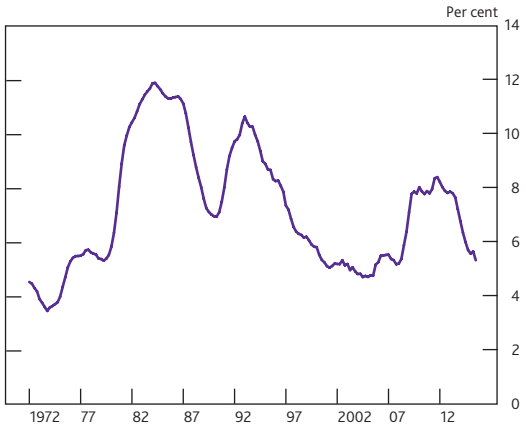
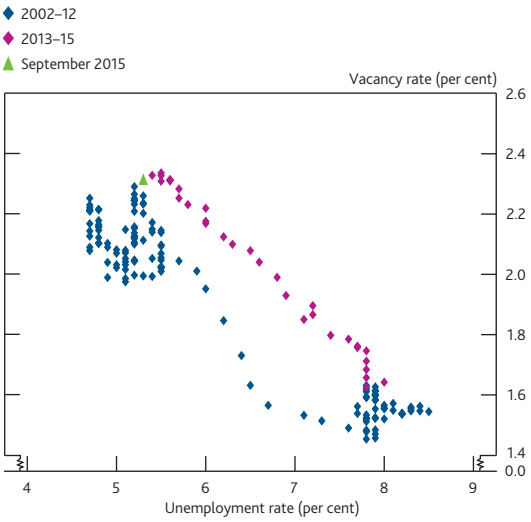


Chart 10 Beveridge curve[a]



(a) The vacancy rate is the stock of vacancies divided by the sum of the number of people in employment and the stock of vacancies.

the level of unemployment consistent with stable wage growth. That means that the unemployment gap that is relevant for determining wage pressure is probably smaller than that implied by the difference between actual unemployment and its long-run equilibrium value. These two concepts of equilibrium are considered in turn.

Long-run equilibrium

The long-run equilibrium rate of unemployment will depend on the structural characteristics of the labour market, such as the degree to which the skills and experience of the pool of potential workers is a good match for the jobs that companies want to fill, the incentives generated by the tax and benefit system for people to take jobs, and innovations in technology that help workers find the right jobs and companies find the right people.

One simple metric for the long-run equilibrium is to look at the pre-crisis period when the unemployment rate was relatively stable and wage pressures appeared contained, suggesting that there was little slack in the labour market. That would point to a long-run equilibrium rate of around 5%.

A more sophisticated approach makes use of economic theory. The 'search and matching' framework has become the standard way of thinking about unemployment in a macroeconomic context. The intuition behind this framework is discussed in a box on page 351 but a key component of it is a relationship known as the Beveridge curve. There is typically a negative relationship between the number of vacancies advertised by companies — which represent unfilled labour demand — and unemployment. This can be seen in the blue diamonds in **Chart 10**. As the number of vacancies fell during the financial crisis, unemployment rose. But the chart also shows that the curve appears to have shifted out more recently; the magenta diamonds are to the right of the blue diamonds.

One interpretation of this is that the unemployment rate consistent with a given level of labour demand is higher than before. That is, there could have been an increase in the long-run equilibrium unemployment rate. But in practice other factors can also shift the Beveridge curve temporarily. One such factor is a temporary rise in long-term unemployment, as it can be harder for people to find jobs quickly if they become more disconnected from the labour market (this is discussed in the section on the medium-term equilibrium rate below). Even taking into account the rise in long-term unemployment, however, there appears to have been an outward shift in the Beveridge curve.

Combining that shift with another element of the search and matching framework, known as the job creation curve (see the box on page 351), might suggest that the long-run equilibrium has risen from around 5% to 5½%. Alternatively, the path traced out by the Beveridge curve can also 'loop' during a cyclical recovery as it takes time for the pickup in vacancies to feed through to lower unemployment. The apparent outward shift may prove to be temporary, therefore, so it is not clear that the long-run equilibrium has shifted from its pre-crisis level.

Moreover, there are a number of structural changes in the labour market that may have pushed down on the long-run equilibrium rate, such as increased participation among older age groups and improvements in educational attainment, both of which are typically associated with lower unemployment rates. Overall, the long-run equilibrium of around 5% assumed by the MPC seems to be a reasonable central case, but risks can be identified in both directions.

Medium-term equilibrium

Even if the unemployment rate ultimately falls back to its pre-crisis average of around 5%, it is possible that the rate of unemployment consistent with stable wage growth might, for a period after the financial crisis, have been higher than that.

A brief description of equilibrium unemployment theory

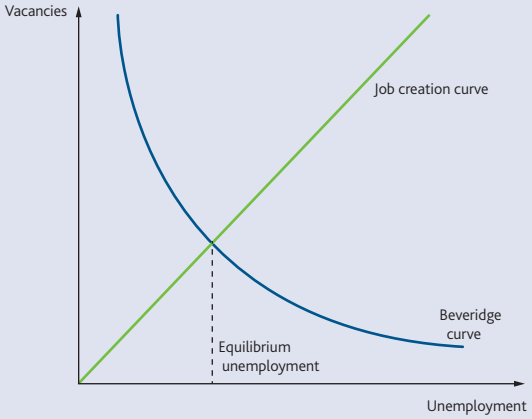
This box provides a brief outline of the 'search and matching' model of equilibrium unemployment, which has become the standard way of thinking about unemployment in the academic literature.(1)

The theory is based on the idea that it takes time and effort for job seekers to find the right job and for companies to find the right employee — a process known as matching. Companies advertise vacancies and try to recruit people from the pool of available workers. The time taken to find the right match means that there are always some people that are unemployed. But the greater the efficiency with which the matching process works, the more quickly new jobs will be created and hence the lower the equilibrium unemployment rate will be in normal times.

The search and matching framework tries to capture the flow of new jobs by looking at the relationship between vacancies — which represent unfilled labour demand — and unemployment. Cyclical variations in labour demand lead to a negative relationship between vacancies and unemployment, known as the Beveridge curve. A stylised example is shown in **Figure A**: when vacancies are unusually high, and companies are trying to recruit lots of people, more job matches are likely to be created and unemployment will tend to be low. Similarly, when labour demand and so vacancies are low, unemployment will tend to rise.(2)

On its own the Beveridge curve does not pin down the equilibrium unemployment rate. We need to know where along the Beveridge curve the labour market is likely to be in normal times. That will reflect the level of labour demand, and in particular companies' decisions on how many vacancies to advertise. Companies will post more vacancies if the potential returns to filling a role are high. That is likely to be the case when unemployment is high, because high unemployment depresses wages and recruitment costs are likely to be low given the wider pool of available workers. In the search and matching framework, this leads to the upward-sloping 'job creation curve' in **Figure A**. The intersection of the Beveridge curve and the job creation curve gives an estimate of the equilibrium unemployment rate. At this point, the flow of new jobs equals the flow of job losses such that the unemployment rate is stable.

Figure A A stylised representation of equilibrium unemployment in the search and matching model



Structural changes in the labour market can lead to a shift in the Beveridge curve, and a change in the long-run equilibrium unemployment rate. For example, if the skills and experience of the unemployed become less well suited to the jobs on offer, it will become harder for companies to find the right employee and so job matches are likely to occur more slowly, even if their demand for labour remains unchanged. Such a deterioration in matching efficiency would shift the Beveridge curve to the right in **Figure A**, and lead to an intersection of the curves at a higher equilibrium unemployment rate.

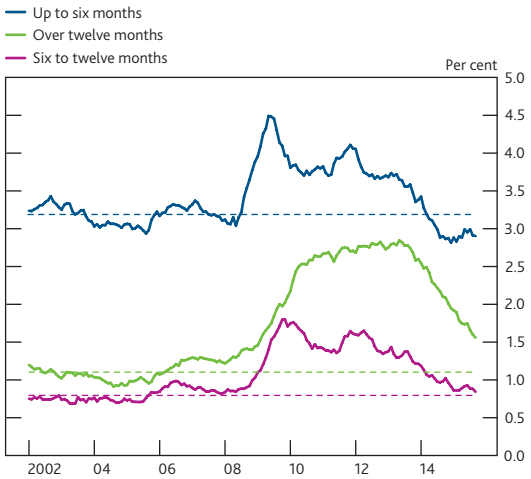
(1) See, for example, Pissarides, C (2000), *Equilibrium unemployment theory*, 2nd Edition, MIT Press, Cambridge MA.
(2) The actual location of the Beveridge curve can be estimated by looking at how the rate at which jobs are created varies in response to cyclical shocks, alongside some assumptions about the rate at which jobs are lost.

This is because recessions are typically associated with a rise in long-term unemployment. And people that have been unemployed for a long period may not exert as much downward pressure on wages as the short-term unemployed, for example because they have become more disconnected from the labour market. Indeed, as evidence of this, the proportion of long-term unemployed people moving into employment is much lower than that for the short-term unemployed.

One way to capture this effect is to calibrate a medium-term equilibrium unemployment rate that rises when long-term unemployment is unusually elevated (since more people may have become relatively more detached from the labour market). The relative likelihood of the long-term unemployed moving into employment can be used to try to quantify this effect.

The persistent increase in unemployment following the financial crisis meant that, taken together, the unemployment rates for those unemployed for six to twelve months and more than twelve months picked up by around 2½ percentage points relative to their pre-crisis average (**Chart 11**). Based on the relative likelihood of those groups moving into employment, the medium-term equilibrium might have shifted up to around 6½% by the end of 2011, well above the estimates of the long-run equilibrium discussed earlier. Since then, much of that increase has unwound, suggesting that the medium-term equilibrium rate has fallen back towards its long-run level.

Chart 11 Unemployment rates by duration[a]



Sources: ONS and Bank calculations.

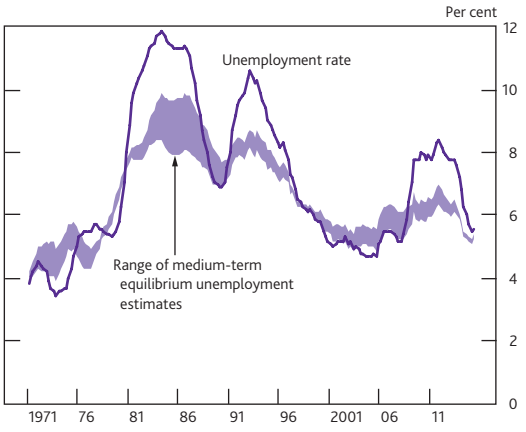
(a) Dashed lines indicate 2002–07 averages.

An alternative way of estimating the medium-term equilibrium unemployment rate is to make use of the relationship between unemployment and wages. When unemployment is low relative to its equilibrium, pay pressures are likely to be high as companies find it difficult to recruit the right people and wages are bid up. This negative relationship between wages and unemployment is often called the Phillips curve.

Statistical filtering techniques can be used to estimate a path for the equilibrium unemployment rate that best explains the observed behaviour of wages, based on the Phillips curve relationship. The estimated equilibrium unemployment rate is allowed to vary over time in these models in order to capture persistent changes in the equilibrium, for example due to changes in the structural characteristics of the labour market or 'hysteresis' effects from changes in long-term unemployment. But it is only allowed to vary in a smooth way that avoids it being buffeted around by short-term volatility in the data.

Different assumptions can be made about the shape of the Phillips curve in these models, and that can lead to different estimates of the equilibrium unemployment rate. For example, the relationship can be assumed to be linear or curved (specifically, convex).(1) It is also possible to add in extra information about the path of output that might improve the estimates of slack given that there is typically a relationship between output and unemployment.(2) The purple swathe in **Chart 12** shows a range of estimates based on different modelling assumptions. The latest estimates point to a medium-term equilibrium rate a little above 5%, close to the actual unemployment rate in 2015 Q3 of 5.3%.

Chart 12 Estimates of the medium-term equilibrium unemployment rate from various statistical filtering models[a]



Sources: ONS and Bank calculations.

(a) The swathe includes three different estimates of the medium-term equilibrium unemployment rate: a baseline model; a model which assumes that the Phillips curve is convex rather than linear and a model which incorporates additional information about the path of output. The sample period is 1971 Q1 to 2015 Q2.

Such estimates of the equilibrium unemployment rate are subject to considerable uncertainty. This can be seen, for

(1) A non-linear relationship would mean that a low unemployment rate pushes up on wages to a greater extent than a high unemployment rate pulls down on wages.
(2) This is known as Okun's Law. When output is low, companies will tend to reduce the amount of labour they use leading to higher unemployment, and *vice versa*.

example, in earlier periods where the different estimates diverge more markedly. Moreover, the models have wide uncertainty bands of at least a percentage point on either side (based on 95% confidence intervals).

Business survey data and information from the Bank's Agents can provide an additional indication of the gap between actual and equilibrium unemployment. When companies report low levels of recruitment difficulties relative to normal, it means that they are finding it relatively easy to find the right people to fill their vacancies. That is likely to mean that there is slack in the labour market, with unemployment above its equilibrium. A range of different survey measures suggest that recruitment difficulties were low following the financial crisis, but have since recovered, and are now at, or slightly above, their pre-crisis averages, consistent with there being relatively little slack in unemployment.

Overall, estimates of both the long-run equilibrium rate and the medium-term equilibrium, which is more relevant for wage pressures, are close to the current unemployment rate, but it is important to stress the considerable uncertainty around any estimates of the equilibrium rate. Moreover, it is possible that the econometric evidence presented here is being affected by the persistence of the cyclical downturn in recent years. Given that unemployment has remained elevated for a long period, the models are likely to attribute some of that to an increase in the equilibrium rate, but as the cyclical recovery continues, if unemployment were to fall further without generating excessive wage pressures such estimates would fall back again.

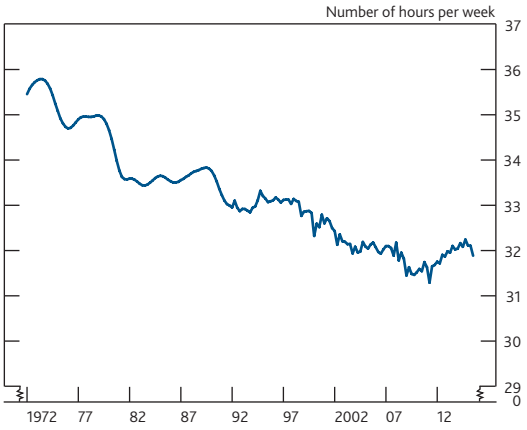
Average hours worked

Prior to the financial crisis, there had been a downward trend in average hours worked since at least the 1970s (**Chart 13**), and probably much longer. Estimates of average hours in the 1850s were around 60 hours per week compared to around 32 hours per week in the run-up to the financial crisis.(1) There was a sharper fall in average hours during the recession, consistent with reduced demand for labour, but since the end of 2009, average hours have increased by around 1¼% and are now at around their pre-crisis level.

Changes in actual average hours following the financial crisis

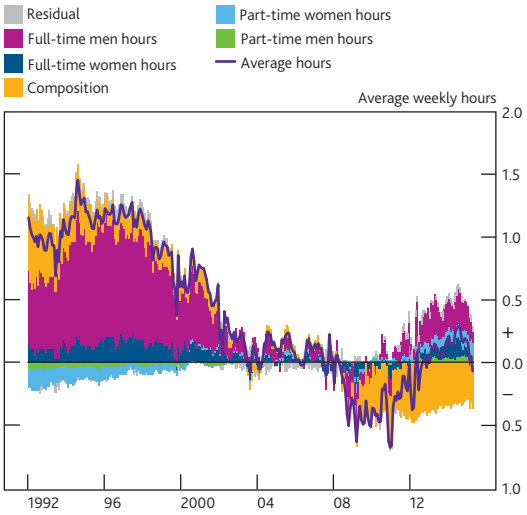
There is a wide distribution in the number of hours people work and shifts in that distribution can have a significant impact on the overall number of hours worked in the economy. One important feature of the recession was a shift towards more part-time work. The share of part-time employment increased by around 2 percentage points between 2007 and 2010. **Chart 14** shows the change in average hours worked relative to 2008 Q3, decomposed into changes in full-time and part-time average hours and changes in the composition of full-time and part-time workers. The

Chart 13 Average hours worked



shift in composition pulled down on overall average hours (the orange bars in **Chart 14**). The part-time share remains elevated, despite the increase in labour demand in recent years.

Chart 14 Contributions to changes in average hours relative to 2008 Q3



Sources: ONS and Bank calculations.

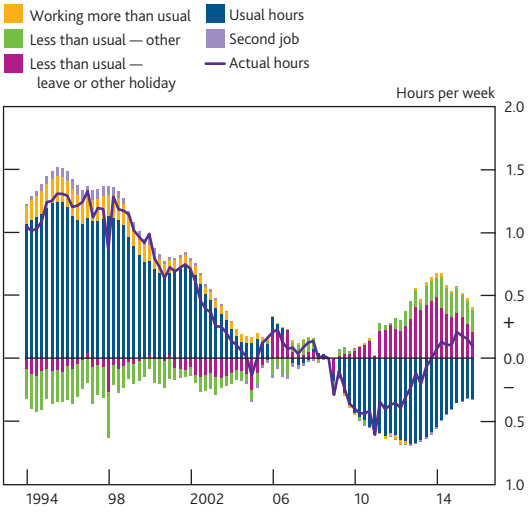
Much of the increase in average hours over the past few years can be accounted for by people taking less holiday on average than they did previously. The LFS asks people about their usual hours of work as well as their actual hours worked in a particular period. In any given week, around 12% of those in employment do not work any hours, and a further 25% report that they worked fewer hours than usual. In part that is because their hours or overtime tend to vary, but it also reflects other factors such as holidays, sickness or parental leave.

As a result, reported average actual hours worked tend to be quite a bit lower than usual hours, and more volatile. **Chart 15**

(1) See the 'three centuries' data set available on the Bank's website at www.bankofengland.co.uk/research/Pages/onebank/threecenturies.aspx.

shows that in recent years usual hours have remained lower than at the onset of the financial crisis, but this has been offset by an increase in average hours due to fewer people saying they were on holiday. That could reflect changes in employment arrangements that will persist, but it may also be due a desire to make up for weak real income growth or people feeling less able to take holiday when labour market conditions are poor.

Chart 15 Contributions to changes in average hours relative to 2008 Q3[a]



Sources: ONS and Bank calculations.

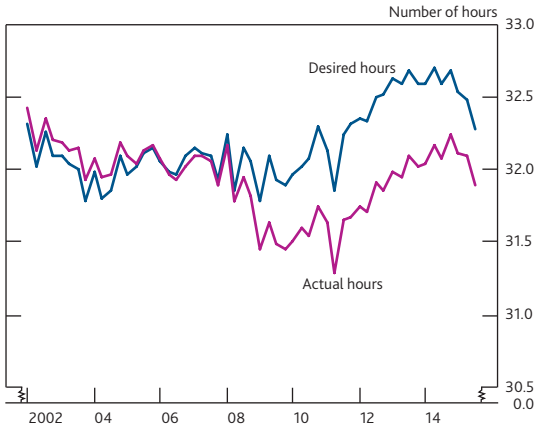
(a) The data shown are four-quarter moving averages.

Underemployment

An important question is whether movements in average hours are structural, reflecting long-term shifts in behaviour, or temporary. Despite the recovery in average hours since the recession, there is evidence that they remain lower than people would like — that is, some people appear to be 'underemployed'. The proportion of part-time workers who say they would like a full-time job has remained elevated relative to its pre-crisis level, which might point to an 'average hours gap' with hours below their trend, or equilibrium, level.

The LFS asks people about the number of hours they would like to work, making it possible to get a more accurate gauge of 'desired hours'.(1) There are always people who want to work more hours, and always some that would like to work less. But in aggregate, the number of additional desired hours has increased substantially since the financial crisis and remains elevated. If people were able to change their hours to what they report to be their desired level in full, that would be equivalent to increasing overall average hours from their current level of 31.9 to 32.3, an increase of around 1¼% (**Chart 16**). The increase in desired hours has mainly reflected part-time workers that would like a full-time job. In large part, therefore, underemployment appears to be concentrated in this group.

Chart 16 Actual and desired average hours[a]



Sources: ONS and Bank calculations.

(a) Desired hours are the number of hours that the currently employed report that they would like to work, on average per week, calculated from LFS microdata, which have been seasonally adjusted by Bank staff.

The amount of slack in average hours will depend on whether this stated desire to work more hours translates into actual increases in hours over time, and there are reasons why that might not happen in full. For example, some of the desire to work more hours may reflect the sharp fall in real incomes during the recession or concerns about the job prospects of other members of a household. As real incomes and labour market conditions recover, the incentive to work more hours may be reduced for some people.

There is also empirical evidence that not all of the reported desired increase in hours tends to feed through into actual hours. During 2013–14 those people that went from being underemployed to reporting that they were happy with their hours did so by increasing their weekly hours, on average, by only five, even though they had said they would prefer to work twelve extra hours.(2) That would suggest that only around half of the increase in desired hours might feed through into the trend for average hours.

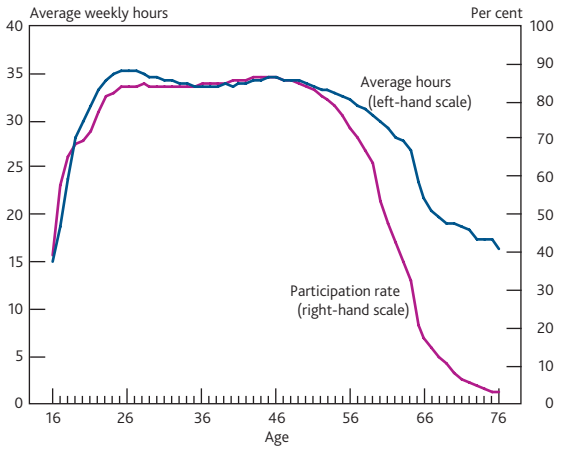
The future evolution of trend average hours

Over time, one factor that might pull down on the trend for average hours is demographic effects. Older workers tend to work fewer hours than most other age groups, as the blue line in **Chart 17** shows. As the share of the workforce in older age groups increases, aggregate average hours might therefore be expected to fall. Although since far fewer older people (especially those aged over 65) work at all, the downward trend in average hours from demographics is likely to be small.

(1) These calculations are based on Bell, D and Blanchflower, D (2013), 'How to measure underemployment?', *Peterson Institute for International Economics Working Paper No. 13–7*.

(2) This is based on looking at how the desired and actual hours of individuals in the Labour Force Survey change over the course of a year. This analysis was originally undertaken in Weale, M (2014), 'Slack and the labour market'; www.bankofengland.co.uk/publications/Documents/speeches/2014/speech716.pdf.

Chart 17 Participation rates and average hours by age[a]



Sources: ONS and Bank calculations.

(a) Average participation rates and hours by age group over the period 1995 to 2015 Q3.

One other factor that might have an effect on the trend is the fiscal consolidation. Average hours for public sector workers are slightly lower on average than for private sector workers, so as the mix of employment shifts towards the private sector that could push up aggregate average hours. But again, the effect here is likely to be very small.

Overall, therefore, the evidence presented would suggest that there has been a flat to rising trend in average hours over the past few years, in contrast to the downward trend seen in previous decades. That would imply that there is a modest amount of slack remaining in this component of labour supply. A slight downward trend may be resumed in the coming years due to demographics, and there is a risk that the trend could fall more sharply if improving economic conditions reduce the incentive to work longer hours.

Overall slack in the labour market

The evidence presented in this section suggests that the growth in the supply of labour in recent years has been robust. Population growth has been strong and, despite some drag from demographic effects, the trends in participation and average hours are likely to have been flat or rising.

Given the sharp fall in total hours worked following the financial crisis, those trends would imply that a margin of slack opened up in participation, unemployment and average hours. Taken together, the overall amount of slack in the labour market appears to have been substantial, and was likely to have been providing a material drag on inflation. Since then, labour market conditions have improved substantially, and much of that slack appears to have eroded. Nevertheless, a modest amount of slack is likely to remain, concentrated in average hours.

Given the considerable uncertainty around any estimate of the trends or equilibria in the labour market, it is difficult to put a precise estimate on the remaining slack. In the face of that uncertainty, it is useful to look at a wider range of evidence when coming to an overall view on the likely amount of slack in the economy.

Alternative ways of estimating slack

The analysis set out so far is only one way to assess the amount of slack in the economy. This section outlines briefly two other approaches that have also been important in informing the views of the Monetary Policy Committee.

Using wages as a signal of labour market slack

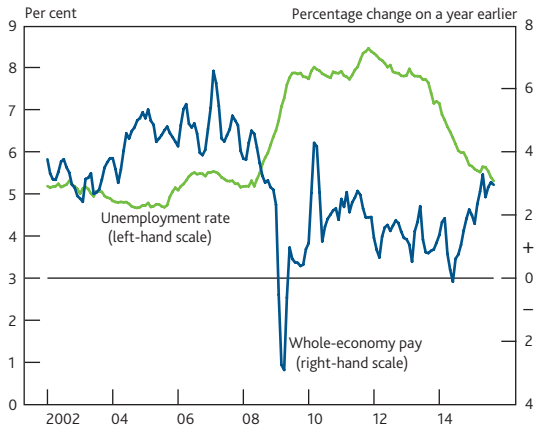
An important channel through which slack in the labour market affects inflation is via wage pressures, so it is possible to use pay developments as a signal of how much slack might remain in the labour market. Information on wages was used in the estimates of the medium-term equilibrium unemployment rate based on statistical filters discussed earlier in this article. But it is also possible to estimate some simple equations that try to capture the effects of overall slack in the labour market on pay, alongside other factors such as productivity and inflation. If pay growth deviates substantially from the path predicted by such equations, that might suggest that slack is higher or lower than is being assumed in the equation.

Pay growth fell sharply in 2008 and 2009 as slack in the labour market rose and productivity fell. It remained weak for several years thereafter, even as unemployment began to fall sharply in 2013 and 2014 and slack in the labour market was being eroded (**Chart 18**). Wage growth was weaker than would be predicted by simple wage equations, and that could imply that there was more slack than implied by the bottom-up analysis in the previous section (which was used to calibrate the measure of slack in the wage equations). There are, of course, other reasons why wages may have been weak over that period and wage growth has picked up more recently, but this may point to a risk that there is a more substantial degree of slack remaining than suggested by the evidence presented earlier in this article.

Top-down estimates

Focusing solely on the labour market when analysing the amount of slack in the economy does not take into account the intensity with which the resources within firms — their labour and capital inputs — are being used. If those resources are being used less intensively than usual, that could represent an additional source of slack, as companies would be able to expand their output without the need for additional workers. Evidence from business surveys can provide an indication of how intensively resources are being utilised relative to normal. Another approach is to try to decompose the path of output into 'trend' and 'cyclical' components, to give a measure of the

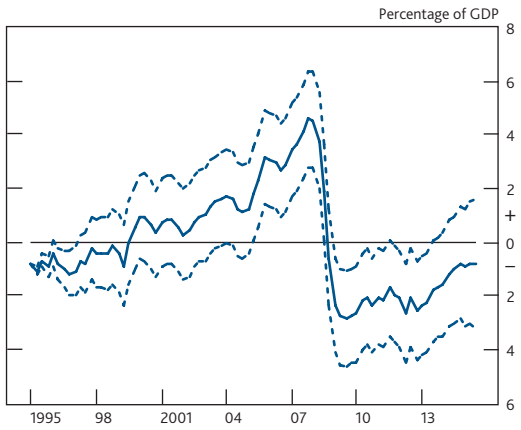
Chart 18 Unemployment and pay



output gap, which can be done using simple statistical filters. A problem with this approach, however, is that the persistent weakness in output since the crisis may mean that too much of that weakness is interpreted as a lower trend.

One way to improve on such techniques is to augment the filter with other information, such as wage and price inflation, which can help to identify the cyclical component. **Chart 19** shows the path for the output gap from one such model, with a negative number indicating a degree of slack in the economy.(1) It suggests that the amount of slack narrowed substantially between 2012 Q4 and 2015 Q2, and is consistent with a relatively small amount of slack remaining. However, the uncertainty around such estimates is wide, as illustrated by the 90% confidence interval shown by the dashed lines in **Chart 19**.

Chart 19 Estimate of the output gap from a top-down filter model(a)



Sources: Bloomberg, ONS and Bank calculations.

(a) The dashed lines represent a 90% confidence interval around the central estimate, illustrating the uncertainty around such estimates. A negative number indicates slack in the economy.

Conclusion

The path of labour supply is a major component of the overall supply capacity of the economy, and will help to determine how much slack there is in the labour market. That, in turn, has an important bearing on monetary policy, through its impact on wage pressures and hence inflation.

Bottom-up analysis of different components of the labour market, such as the participation rate, the unemployment rate and the average hours worked by those in employment can shed light on the underlying trends in those variables. Labour supply growth appears to have been robust since the financial crisis. In particular, participation among older age groups has increased, and in aggregate people in employment appear to want to work more hours than they currently do. A strong trend for labour supply implies a substantial build-up of slack in the labour market between 2008 and 2011 as actual total hours worked fell sharply. More recently, as the demand for labour recovered, much of that slack appears to have been used up, although a small amount is likely to remain.

There is substantial uncertainty around any estimate of slack in the economy, and it is prudent to draw on a range of evidence. Different analytical approaches can give different steers: the persistent weakness of wages in 2013 and 2014 highlighted the risk that there may be more slack than suggested by the bottom-up evidence, for instance, whereas top-down estimates based on statistical filters point to a relatively small amount of slack remaining. In the November 2015 *Inflation Report*, the Monetary Policy Committee's best collective judgement was that spare capacity of around ½% of GDP remained, focused in the labour market, but it also noted that there was a wide degree of uncertainty around that estimate and a range of views on the Committee.

(1) The model includes five variables: GDP growth, the unemployment rate, a measure of long-term unemployment, CPI inflation excluding food and energy and a financial conditions index. The Kalman filter is used to decompose the path of output into trend and cyclical components.