BANK OF ENGLAND

Speech

The UK productivity puzzle – a sectoral perspective

Speech given by

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Over the past year, the economy has seen a remarkable recovery – the pace of which has caught many by surprise. Output has grown on average by 0.8% per quarter since last summer, and by the first quarter of this year was just half a percent short of its pre-crisis peak. Over the same period, over half a million jobs (roughly 700,000) were created, pushing the unemployment rate down to 6.6% in April. And employment surveys suggest that gross hiring is likely to continue at a robust pace in coming months (**Chart 1**).

The prospects for a sustained recovery now look better than for some time. But behind that good news lies a continuing puzzle. While the creation of new jobs is to be welcomed, its pace and timing, relative to the increase in output, leaves unanswered questions about the productivity performance of the economy.

Typically, labour market variables lag changes in activity. At the onset of recessions, companies take time to lay off employees as they gauge the extent of the contraction in demand, so the rise in unemployment tends to follow the decline in activity. Conversely, in the early stages of recovery, companies tend to wait before hiring new staff, as they assess the durability of the pickup in demand, and initially seek to match it by working their existing employees more efficiently. As a result, job creation tends to lag the recovery in output. This explains why productivity has typically been pro-cyclical: output per worker tends to rise or fall with output, as adjustments to headcount come with a lag.

The puzzle that continues to exercise the Monetary Policy Committee (MPC) is that the behaviour of productivity in the aftermath of the financial crisis has been very different from historical experience. Productivity has been extremely and uncharacteristically weak since the end of the recession in mid-2009, compared with the episodes of the 1980s and 1990s (**Chart 2**). As of 2014Q1, productivity, measured as output per worker, was still roughly 3.5% below its pre-crisis level in 2007.

A number of explanations have been put forward to explain this weakness in productivity. Initially, many felt that it could be simple error in the measurement of the GDP data. This cannot be ruled out, although the size of the productivity shortfall would make that measurement error very large indeed. As the puzzle persisted, other hypotheses have been advanced, some by my colleagues, including: forbearance on the part of banks and the low interest rate environment keeping unproductive firms alive; stresses in the banking sector impairing the efficient allocation of capital,[1] and firms faced with uncertainty choosing to substitute labour for capital.[2] In a speech given in early 2013, I offered a further explanation: that part of the productivity puzzle is a by-product of companies' rational decisions to hold on to their employees for their firm-specific skills, even when faced with weak demand.[3] And earlier this week, a Quarterly Bulletin article by Bank staff was published which offers a very comprehensive, if not necessarily exhaustive, review of the factors behind the weakness of productivity since the financial crisis.[4]

[1] See Broadbent (2012).
[2] See Miles (2012).
[3] See McCafferty (2013).
[4] See Barnett et al (2014).

Even taken together, these explanations still leave a good deal of uncertainty as to the sources of the weakness of productivity. Yet a fuller understanding of why productivity has remained so weak, and to what extent it is therefore likely to recover, is critical for the path of interest rates as the expansion continues.

Of particular importance is the extent to which supply responds to demand over the next two-to-three years. Under the second phase of our forward guidance, which came into effect in April when the unemployment rate fell below 7%, the MPC is focussing on the degree of slack in the economy, both within the labour market and within companies. There is, as you might expect with a concept that is difficult to measure, some difference of opinion amongst the Committee as to the exact *level* of slack that currently exists, although we can agree that there is some still to absorb before full capacity is reached. But equally important, as we look forward over the next two to three years, is the *pace* at which that existing spare capacity will be absorbed, and critical to that will be the degree to which productivity recovers.[5] In a nutshell, the faster the recovery in productivity, the slower the absorption of remaining spare capacity over the forecast horizon, which would allow a longer time before the first rise in interest rates and a more gradual trajectory thereafter.

A sectoral approach to the productivity puzzle

As I alluded to earlier, most approaches have sought to explain the weakness of productivity by appealing to whole-economy explanations. That is quite natural for macroeconomists – especially so for monetary policymakers concerned with fluctuations in aggregate demand. But the behaviour of aggregate productivity in recent years has masked stark differences across sectors, with some sectors exhibiting dramatic declines in productivity, and others experiencing productivity movements more akin to those in previous cycles. While such differences do not in themselves rule out a set of common whole-economy drivers, they are sufficiently stark to suggest that the reasons behind the productivity weakness are likely to be more numerous, diverse and complex than sometimes assumed.

So today I would like to examine the productivity puzzle from another angle – by adopting a sectoral approach. I will first look at productivity performance by sector, and in some cases, sub-sector of the economy. Even though the data at the lower levels of disaggregation are less robust, such disaggregation into subsectors is necessary to obtain a sufficiently granular and homogenous set of economic activities within each subsector. To give one example: 'Transportation & Storage' covers activities as diverse as warehousing, freight transport and postal and courier services. Only by breaking this sector into the individual economic activities can the very different developments in measured productivity for each activity be understood, and potential causes identified.

To provide likely *explanations* of the causes of differential productivity performance across sectors, I will draw on a database of intelligence compiled by the Bank's Agency network from their company visits. The Bank's Agents visit about 5,500 company contacts each year, and the intelligence they gather provides

[5] See 'Monetary policy as the economy recovers', pp 8-9, February 2014 *Inflation Report*

direct evidence of the factors affecting business performance, both from the company itself and via the Agents' interpretation.

I will focus on those sectors which have seen dramatic falls in productivity since 2007. It is these sectors that have driven the recent weakness at a whole-economy level, and which are most likely to determine to what extent productivity performance improves as the recovery continues. In particular, I will try to draw some conclusions for each of these sectors that distinguishes the element of their weak productivity performance that has been caused directly by the persistent weakness of demand (demand-contingent productivity weakness) – which might be expected to recover as demand strengthens and broadens – and the element that is independent of the cycle (non-cyclical productivity weakness) which might be expected to recover only more slowly, if at all.

Sectoral productivity performance

As a first pass, it is possible to break down the shortfall in whole-economy productivity by sector, based on the UK Standard Industrial Classification (SIC). **Table 1** ranks the 18 high-level sectors that make up aggregate UK gross value added (GVA), in descending order of their percentage contribution to the shortfall in aggregate productivity relative to 2007.[6]

To be clear, the shortfall here is calculated as the percentage difference between the level of productivity in 2013Q4 and that in 2007, rather than relative to some pre-crisis trend. This is different to some previous treatments (such as in the recent *Quarterly Bulletin* article), but bypasses the need to calculate trend productivity in each sector, a thorny issue given the volatility of the data, and allows us to be agnostic about the extent to which any pre-crisis trend should be extrapolated post-crisis. That said, the magnitude of the measured shortfall will inevitably depend on the exact reference year chosen (2007 in this case).

However, there are two statistical issues that require caution when interpreting this sectoral breakdown. The first is that the output measure is the output GVA data, not balanced to the expenditure measurement of GVA, let alone GDP. Second, the chain-linking methodology used by the ONS means that sectoral estimates do not aggregate to published totals before 2010. As a result, the bottom-up, GVA-based shortfall of 5% shown in Table 1 is not directly comparable with the whole-economy, GDP-based shortfall of 3.5% shown in Chart 1. For these reasons, the emphasis in reading the table should be placed on the relative contributions of the various sectors, rather than the precise magnitude of the shortfall.[7]

[6] Note that calculations are based on output GVA data, which are not balanced to the income and expenditure measurements of GVA. The sectoral output GVA data are compiled by the ONS and can be found here: http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-328821. Although the data are chain-linked, the annual chain-linking methodology introduced in 2003 means that sectoral estimates do not aggregate to published totals 'except after the last year which is used as a base year', which is 2010 in the current vintage (see 'The effects of annual chain-linking on the output measure of GDP' for more information). As a result, the aggregate shortfall of 5% between 2007 and 2013Q4 shown in Table 1, which is calculated by aggregating the sectoral GVA data, is not directly comparable with the expenditure-based GDP aggregate shown in Chart 1.

[7] A further complication is that while the output data are collected at reporting unit level, the Workforce Jobs employment data are reported at local unit level. This may introduce distortions into the absolute sectoral productivity calculations, but that is the only way to disaggregate the data sufficiently for our purposes.

One is struck by the fact that only six sectors – representing close to 40% of total GVA and total employment – "explain", at least in an accounting sense, the aggregate productivity shortfall. Moreover, the magnitude of the shifts in these six sectors – individual contributions of at least 10% – far outweighs the fluctuations in other sectors. These sectors (with their percentage contribution to the aggregate productivity shortfall in brackets) are: 'Mining & quarrying' (22%), Financial & Insurance' (20%), 'Transportation & storage' (19%), 'Education' (16%), 'Professional, scientific & technical activities' (16%), and 'Health & social activities' (10%).

Looking at the rest of the table, six other sectors have seen smaller falls in productivity since 2007,[8] but, again in an accounting sense, their contribution is roughly balanced by the five sectors where productivity has risen over the past six years.[9]

The table also indicates the changes in output and employment relative to 2007, to give a sense of the relative importance of each in driving productivity change.[10] It is immediately apparent that the sectors which have made a sizeable contribution to the aggregate productivity shortfall have each experienced very different employment and output dynamics.

Some, such as 'Mining & quarrying' and 'Transportation & storage', have seen outright falls in output but gains in employment. Others, such as 'Education' and 'Professional, scientific & technical activities' have experienced increases in output, but even larger ones in employment. And other sectors, such as 'Financial & Insurance', have seen falls in output accompanied by smaller declines in employment. Even at this higher level of disaggregation, the diversity of performance suggests that a number of different explanations may lie behind.

But at this high level of sectoral disaggregation, the economic activities represented by many of these sectors are far from homogeneous. In the financial sector, for example, what is happening in banking is likely to differ from what is happening in insurance, so that the patterns of output and employment at this level do not necessarily offer the best characterisation of what is going on in the many sub-sectors (or divisions in ONS parlance) that make up those sectors.

This is why it is necessary to delve into greater detail, using the low-level GVA aggregates compiled by the ONS. However it is worth noting that these estimates are not part of regular ONS publications, because they can be very volatile and subject to revision, and as such they need to be interpreted with caution.

For our purposes, this means that aggregating the productivity data for each of the low-level GVA divisions yields an estimate of the whole-economy productivity shortfall since 2007 (of 5.4%) that is different not only from that based on the aggregate GDP data (3.5%) but also from that calculated by aggregating the

[8] 'Construction','Other services', 'Electricity, gas & steam', 'Accommodation & food services', 'Water supply', 'Agriculture' and 'Real estate less imputed rent'.
[9] 'Manufacturing', 'Public administration', 'Wholesale & retail trade', 'Administrative & support activities' and 'Information & communication'.
[10] The lack of reliable sectoral data on average hours worked means it is not possible to investigate the extent to which changes in average hours worked might have offset or exacerbated changes in employment in different sectors.

higher-level GVA sectors (5.0%). In other words, the low-level GVA data can help us to uncover which divisions have been the largest contributors to the weakness of aggregate productivity since 2007, but little weight should be placed on the exact percentage point contribution to the whole-economy productivity shortfall.

We can thus rank the low-level divisions that make up aggregate UK GVA, in descending order of their percentage contribution to the shortfall in aggregate productivity relative to 2007 – bearing in mind that not too much should be made of the precise ordinal ranking.

Table 2 focuses on those divisions that make a contribution of at least four percent to the aggregate productivity shortfall since 2007. Among these, eight divisions account for the entirety of the weakness of productivity over the past six years. These are 'Mining and the extraction of crude petroleum/gas' (22%), 'Education' (15%), 'Financial service activities' (excluding insurance and pension funding) (13.5%), 'Social work activities' (12%), 'Activities of head offices; Management consultancy' (11%), 'Services to buildings and landscape activities' (10%), 'Warehousing and support activities for transportation' (9%), and 'Postal and courier services' (8%).

The remaining six divisions "over-explain" another 30% of the puzzle – these are: 'Wholesale trade' (excluding motor vehicles) (6%), 'Activities auxiliary to financial services and insurance activities' (5.5%), 'Construction of buildings' (5%), 'Residential care activities' (4.5%), 'Electricity, gas, steam and air conditioning supply' (4.5%) and 'Legal and accounting activities' (4%).

Unsurprisingly, the vast majority of these divisions belong to sectors that feature at the top of Table 1, but others, including 'Services to buildings and landscape activities' or 'Wholesale trade', are not picked up by the higher level data.

The table also provides a series of narratives for the observed productivity performance of each division, based on the intelligence obtained by the Bank's Agents during their company visits.

Looking through the narratives, a number of explanations span several divisions. But let me deal with those that are more sector-specific first.

The single largest contributor (22%) to the productivity shortfall since 2007 is oil and gas extraction, which makes up the bulk (roughly 70% in 2013) of the Mining & quarrying sector. The story here is familiar: the gradual depletion of reserves and the growing obsolescence of production equipment has been behind a persistent decline in production for some years, while the need for minimum staffing levels in a capital-intensive industry, combined with the need for increasingly complex maintenance and investment, have prevented staffing levels from adjusting fully to the change in output.

‘Education’ contributes about 15% to the productivity shortfall, but interpreting the measured fall in output per head in that sector needs to be done with great caution. Gross value added, which captures the numbers of nursery, primary and secondary pupils (adjusted for attendance and including an annual quality adjustment), has risen since 2007, mirroring the growth of population. But the number of employees (teachers, teaching and other support staff) has risen even faster. This may reflecting a shift in the employment mix due to a greater use of teaching assistants in response to budgetary pressures. That the measurement of heads takes no account of changes in employment mix, and that fully quality-adjusted output is so difficult to measure in this sector gives few insightful conclusions, other than, as measured, it is a sizeable contributor to the measured fall in aggregate productivity.

‘Services to buildings and landscape activities’, which essentially consists of cleaning services and landscaping, and accounts for 10% of the aggregate productivity shortfall, is likely to have seen staffing numbers rise as customers look to outsource services in an effort to reduce their costs, while competitive pressures and re-tenders have kept service levels low.

The narratives for ‘Social work’, ‘Wholesale trade’ and ‘Residential care activities’, three sub-sectors that respectively account for 12%, 6% and 4.5% of the productivity shortfall, are less well supported by the Agents’ intelligence network. It is possible however to make some informed conjectures about what has been behind the relative movements of output and employment in these sectors.

Much like ‘Education’, ‘Social work’, which broadly refers to counselling and welfare services carried out by government offices or private charitable organisations, and ‘Residential care activities’, which mainly refers to nursing care activities, are sectors where both output and employment are difficult to measure and interpret. One possible, yet partial, explanation for the weakness of output relative to employment in ‘Social work’ since 2007 is a move to the provision of foster care rather than institutional care for children. Foster care is less costly but is believed to be of much higher quality. However, in the measured data for such activities, such a shift to a lower-cost from a higher-cost service can appear as a lesser increase in output.

A number of themes run through the narratives of the other divisions. Let me explore each in turn.

The first theme is **changing regulation.** This has required companies in several sub-sectors to maintain or increase staffing levels relative to output. In financial services (both traditional banking and auxiliary services such as brokers and exchanges, which taken together account for roughly 19% of the productivity shortfall) and to a lesser extent in ‘Legal and accounting activities’, more staff are required to manage new infrastructure, system and regulatory requirements. In a similar vein, the construction sector (which contributes 5% to the productivity shortfall) reports that it has been affected by increased regulation of the environmental impact of construction. Given a low-margin environment, the associated rise in building costs has led customers to request redesigns to remove cost elsewhere, weighing on the productivity of construction workers. In ‘Warehousing and support activities for transportation’ (which accounts for 9% of the productivity shortfall), tighter security measures at airports have led to falls in productivity as airport

management hire additional staff in response to delays in passing through security. In 'Electricity, gas and steam', which accounts for 4.5% of the shortfall, it is likely that regulated green initiatives may well have increased staffing levels ahead of current output.

These explanations help to explain why productivity, as measured, has been weak, but of course, the reduction in productivity in the data could also be described as a correction of previous mismeasurement of output, as the previous negative externalities that are the object of the regulation were not fully captured.

The second theme is a **change in business model or mix**. Many firms are able to adapt to a change in the type of business they operate over the long term, but still face challenges to their productivity during the transition period. Productivity in 'Financial services' has probably been affected by the need to reduce leverage and increase capital, limiting the potential return of certain activities previously deemed to be highly productive (whether this was indeed the case once fully risk adjusted is less clear). This has had a knock-on effect on a range of other professional services, such as 'Legal and accounting', where the mix of work has shifted away from supporting such riskier activities. 'Postal and courier services', which accounts for about 8% of the aggregate productivity shortfall, has seen a substantial change in its business mix. There has been a large rise in the processing of parcels and packages at the same time as a continuing trend decline in conventional letters, to which the industry is still adjusting.

Another recurrent theme is a **tough trading environment**, which makes it harder for companies to win work, or complete it effectively. This has depressed productivity as competition has led to more resources chasing fewer new projects, while uncertainty has led to project delays, pushing up the number of average hours per project. This is reported by companies in several sub-sectors that include professional services such as 'Activities of head offices; management consultancy', 'Activities auxiliary to financial services and insurance activities' and 'Legal and accounting activities'. It has also been a factor for 'Warehousing and support activities for transportation' as the financial crisis has led to a consolidation of transport routes in airline and shipping, as well as for the construction industry.

Labour retention is another common theme. As I mentioned in a speech last year,[11] companies in a range of sectors such as 'Activities of head offices; management consultancy', 'Legal and accounting activities'; 'Construction of buildings' and 'Electricity, gas and steam' have held on to staff to avoid the high cost of subsequent recruitment. This is particularly pertinent for some sectors, such as law and accounting, where training times make it difficult to change the supply of staff at short notice.

Finally, the need to maintain a **minimum operating scale** is cited by companies in the 'Warehousing and support activities for transportation', where transport infrastructure companies, in particular in airports and ports, have low variable staffing costs relative to fixed staffing needs (e.g. the need to maintain air traffic control numbers). This has also been true for other sectors, such as a banks or building societies, where the

[11] See McCafferty (2013).

desire to maintain a branch network or keep in place a distribution chain has forced companies to maintain a core staff base.

Several of these themes, including a tough trading environment, minimum operating scale and skilled labour retention combine for 'Wholesale trade', a sector mainly consisting of business-to-business transactions in the manufacturing sector (including self-distribution by manufacturers to retail outlets), in which we have seen relatively muted falls of employment compared to changes in output.

Finally, there is also some evidence that a high level of bank forbearance may have played a part in depressing productivity the construction sector, allowing firms to continue to stay in business as demand was collapsing.[12]

Clearly, some of these productivity drivers are closely linked to the business cycle, and are "demand-contingent" while others are "non-cyclical", which is not to say permanent. By characterising a driver as "non-cyclical", I simply mean that it does not depend primarily on a recovery in demand – I make no tacit judgment about how long-lasting or permanent it might be. But even for those drivers that are closely tied to the evolution of demand, there is no necessity that productivity will recover *at the same pace* as demand. There could still be lags.

Nevertheless, a qualitative assessment of the relative importance of the demand-contingent and non-cyclical nature of each of the sectoral narratives allows us to form a view on the degree to which supply might respond to the strengthening of demand. It can therefore help inform our judgment about how rapidly the output gap might be expected to close, as the upswing continues.

Drivers such as a tough operating environment, labour retention and minimum operating scale look to be primarily "demand contingent". As demand recovers and the volume of business increases, less time will be spent bidding for new contracts, allowing employees' resources to be re-deployed to more productive work. In activities in which there has been labour retention or a minimum operating scale, increasing demand can be met by the existing workforce.

Drivers such as stricter regulation and change in business mix are likely to be more "non-cyclical". There is little direct link with existing levels of demand, and as such, they are unlikely to be unwound in tandem with a recovery in demand.

Bringing these together in **Table 3**, it appears that the cumulative contribution to the shortfall of those divisions where the weakness of productivity is predominantly explained by non-cyclical drivers (which we estimate at some 60%) is slightly greater than that of the divisions where weak productivity primarily reflects demand-contingent drivers (40%).

[12] See Arrowsmith et al. (2013).

Rather than simply allocating a demand-contingent or non-cyclical explanation to each division, we can apply a judgment as to the relative weight of each by division. This alternative approach provides a similar result. **(Table 4)**. Using this method suggests that again, slightly more of the weakness of productivity over the past six years has been non-cyclical (56%) rather than demand-contingent (44%).

Implications for policy

What are the implications of this for our understanding of the economy and for monetary policy?

The key issues currently facing the MPC are estimating the current level of slack, and the pace at which it will be absorbed as the recovery develops. Assessing the pace at which slack is likely to be absorbed requires a judgment on how much aggregate supply is likely to respond to increases in demand through a recovery in productivity growth. Our current judgment, built in to the May *Inflation Report* forecast, is that productivity will recover as demand strengthens, but that the rate of productivity growth over the next couple of years is unlikely to materially exceed pre-crisis rates (**Chart 3**) – that is, supply will partially respond to the pick up in demand, but the catch up in productivity levels over this period is likely to be limited. Nevertheless, this gradual pickup in productivity means that, on the basis of the current forecasts for demand growth, the absorption of slack over the forecast period slows relative to the recent past.

With roughly 40% of the productivity shortfall appearing to be "demand contingent", my sectoral analysis of the productivity puzzle broadly supports the MPC's central view of a gradual recovery in productivity as the economy recovers. Nevertheless, the fact that 60% appears to be unrelated to the cycle of demand also suggests that some of the weakness may well be more persistent, and that a more rapid recovery in productivity than currently expected over the next couple of years is perhaps hoping for too much. It is not that this element of the productivity shortfall is necessarily lost forever, but that it might take some time to reverse, and this will be driven by factors independent of the strength of demand.

Moreover, the analysis still leaves a good deal of uncertainty as to how rapidly and at what stage in the recovery the recovery in productivity will appear, and this has significant implications for the judgment of how fast slack is being absorbed and the timing of the eventual closure of the output gap. Both of these estimations are particularly sensitive to small changes in either the pace of output growth or the pace of productivity recovery through the forecast period.

The absorption of slack, which is central to the framework that underpins the second phase of forward guidance, will continue to guide our decision making. But we must resist the temptation to demand too much precision from such calculations of slack and the estimated relationship between slack and inflation pressures. As I argued in a recent speech,[13] we will also need to be alert to signals of any build up in wage

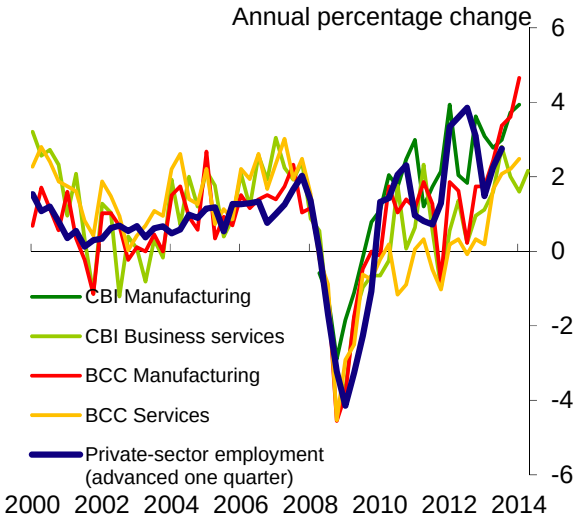
[13] See McCafferty (2014).

settlements and margin expansion – direct signals that the absorption of slack is beginning to affect price pressures.

Faced with such uncertainties about the likely pace of absorption of slack, a prudent policy maker, in my view, would want to start to remove some of the current extraordinary level of monetary stimulus a little before the output gap is fully closed. But on this occasion, there is an additional reason not to hold back too long. Once the normalisation of monetary policy gets underway, I believe it will be critically important that rises in Bank Rate are delivered, as far as we are able, at only a modest, gradual pace. This will be necessary to allow consumers and businesses, who are likely to be more than normally sensitive to changes in interest rates in the early stages of the tightening cycle, to adapt without undue disruption to spending or damage to confidence.

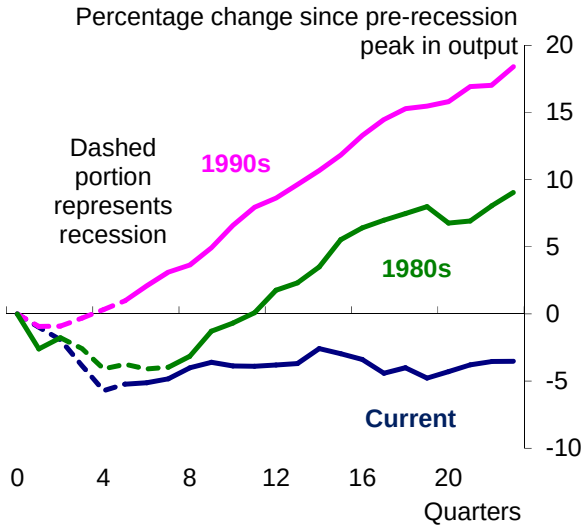
The decision on when it will become appropriate to begin the normalisation of policy is becoming more balanced as the economy has strengthened through the early summer. As ever, our decisions on monetary policy will depend critically on the evolution of the data over the coming months.

Chart 1: UK employment intentions surveys



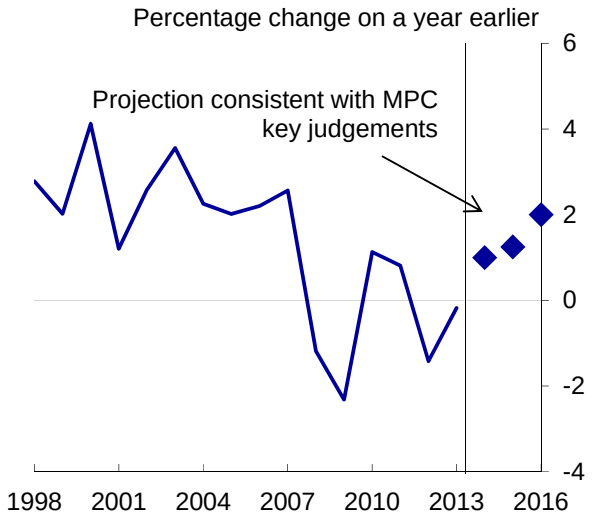
Source: ONS, CBI and BCC.
Surveys normalised to annual growth of private-sector employment. Employment intentions are percentage balance of employers planning to recruit staff over the next three months.

Chart 2: UK output per head



Source: Labour Force Survey (ONS) and Bank calculations.
The peaks in output were in 1979Q4, 1990Q2 and 2008Q1.

Chart 3: UK productivity growth forecast



Source: ONS and Bank calculations. See Chart 5.6 of the May 2014 *Inflation Report*.

Table 1: High-level sectoral contribution to whole-economy productivity shortfall relative to 2007

Output weights (2007)	Employment weights (2007)	Sector (% indicates share in 2010 GVA)	Productivity gap (%) relative to 2007	Contribution to aggregate productivity gap (pp)	% contribution to aggregate productivity gap	Output gap (%) relative to 2007	Employment gap (%) relative to 2007
100	**100**	**Whole economy (100%)**	**-5.0**	**-5.0**	**100**	**-1.6**	**3.4**
2.8	0.2	Mining & quarrying (2.3%)	-55.1	-1.1	**22**	-37.7	17.5
10.5	3.7	Financial & insurance (9.5%)	-7.3	-1.0	**20**	-11.0	-3.7
5.4	4.7	Transportation & storage (4.4%)	-17.2	-0.9	**19**	-17.0	0.2
6.5	8.1	Education (6.2%)	-9.3	-0.8	**16**	2.4	11.7
7.5	7.1	Professional, scientific and technical activities (6.9%)	-11.5	-0.8	**16**	8.6	20.1
7.2	11.5	Health & social activities (7.6%)	1.9	-0.5	**10**	16.6	14.7
7.0	7.3	Construction (6.3%)	-4.1	-0.3	**5**	-11.5	-7.5
3.1	5.2	Other services (3.4%)	-4.0	-0.3	**5**	2.4	6.4
1.3	0.3	Electricity, gas & steam (1.3%)	-52.8	-0.2	**5**	-9.1	43.7
2.9	6.3	Accommodation & food services (2.7%)	-5.6	-0.2	**4**	-4.1	1.5
1.4	0.5	Water supply, sewage, waste management (1.2%)	-26.2	-0.1	**3**	0.5	26.7
0.7	1.2	Agriculture (0.7%)	-7.9	-0.1	**2**	4.7	12.6
2.9	1.4	Real estate less imputed rent (2.9%)*	-15.3	0.0	**0**	16.4	31.7
11.7	9.3	Manufacturing (10.4%)	3.8	0.1	**-3**	-8.6	-12.3
5.5	5.6	Public administration & defence (5.4%)	3.7	0.2	**-4**	-8.8	-12.6
12.3	15.8	Wholesale & retail trade (11.1%)	1.3	0.2	**-5**	-0.9	-2.2
5.0	7.9	Administrative & support activities (4.6%)	10.9	0.3	**-5**	20.2	9.4
6.2	3.9	Information & communication (6.4%)	6.4	0.5	**-10**	9.8	3.4

* Imputed rent is subtracted from 'Real estate' GVA because the income stream associated with the ownership of dwellings and other property is insensitive to employment. Removing imputed rent brings the weight of 'Real estate' in total GVA to 2.9%, from 9.7% when imputed rent is included. 'Other services' refers to 'Arts, entertainment & recreation', as well as 'Other service activities'.
Gaps calculated between 2007 and 2013Q4. For each sector, the productivity gap is calculated by subtracting the employment gap from the output gap, while the percentage point contribution to the aggregate productivity gap is calculated by subtracting the employment gap times the employment weight from the output gap times the output weight. For any sector, when the output and employment weights differ markedly, the sector's contribution to the aggregate productivity shortfall may have a different sign than that sector's own productivity shortfall would imply (e.g. Health & social activities).

Source: ONS and author's calculations.
Output measured as sectoral Gross Value Added, available at http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-328821. Although the data are chain-linked, the annual chain-linking methodology introduced in 2003 means that sectoral estimates do not aggregate to published totals before the base year, which is currently 2010 (see 'The effects of annual chain-linking on the output measure of GDP'). As a result, the aggregate shortfall of 5% is not comparable with the expenditure-based aggregate published by the ONS. For employment, Workforce jobs data are scaled up by the Labour Force Survey.
A list of the UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007) can be found here: http://www.businessballs.com/freespecialresources/SIC-2007-explanation.pdf

Table 2: Low-level sectoral contribution to whole-economy productivity shortfall relative to 2007

Output weights (2007)	Employment weights (2007)	**Division**	**Sector**	**Productivity gap (%) relative to 2007**	**Contribution to aggregate productivity gap (pp)**	**% contribution to aggregate productivity gap**	**Output gap (%) relative to 2007**	**Employment gap (%) relative to 2007**	**Narrative**
100	**100**	**Whole economy**	**Whole economy**	**-5.4**	**-5.4**	**100.0**	**-2.0**	**3.4**	
2.4	0.1	Mining of coal and lignite; Extraction of crude petrol/gas	Mining & quarrying (B)	-75.2	-1.2	**21.9**	-48.2	26.9	Structural decline in UK oil and gas output. Minimum staffing in capital intensive industry.
6.5	8.1	Education	Education (P)	-9.3	-0.8	**14.8**	2.4	11.7	Employment-mix changes in response to budgetary pressures.
7.2	2.1	Financial service activities, except insurance and pension funding	Financial & insurance (K)	3.3	-0.7	**13.4**	-15.5	-18.8	Change in the business mix away from riskier activity. Minimum operating scale, through desire to maintain branch/distribution network, supporting core employee base. Increased staffing to meet stricter regulations / greater focus on risk management / deal with substantial business change.
1.0	2.7	Social work activities without accommodation	Health & social activities (Q)	-19.7	-0.7	**12.3**	8.3	27.9	NA
1.3	1.7	Activities of head offices; management consultancy	Professional, scientific & technical activities (M)	-30.8	-0.6	**11.1**	12.4	43.2	Labour retention to avoid skills mis-match in light of training lags / 90s experience Tough trading environment: economic uncertainty led to project delays and higher average hours per project
0.6	2.0	Services to buildings and landscape activities	Administrative & support activities (N)	-31.1	-0.5	**10.0**	-5.1	26.0	Staffing levels supported by increased drive by customers to outsource services. Competition and re-tendering pressures have reduced service levels and measured output.

Output weights (2007)	Employment weights (2007)	**Division**	**Sector**	**Productivity gap (%) relative to 2007**	**Contribution to aggregate productivity gap (pp)**	**% contribution to aggregate productivity gap**	**Output gap (%) relative to 2007**	**Employment gap (%) relative to 2007**	**Narrative**
1.4	1.3	Warehousing and support activities for transportation	Transportation & storage (H)	-36.6	-0.5	**9.2**	-13.5	23.1	Minimum operating scale supporting core employee base. Tough trading environment leading to a depression in transport volumes during crisis Tighter security regulation impacting on productivity
1.1	1.0	Postal and courier services	Transportation & storage (H)	-36.6	-0.4	**7.9**	-42.3	-5.7	Change in business mix away from conventional post to processing of larger parcels and packages.
4.4	4.0	Wholesale trade, except of motor vehicles and motorcycles	Wholesale and retail trade (G)	-6.9	-0.3	**6.1**	-12.4	-5.6	Minimum operating scale. Tough trading environment. Labour/skills retention.
1.5	1.1	Activities auxilliary to financial services and insurance activities	Financial & insurance (K)	-30.5	-0.3	**5.6**	10.3	40.8	Spill-overs from stricter regulation / business change in core FS leading to higher staffing levels. Change in business mix away from supporting risky FS activities Tough trading environment making it harder to compete for work.
2.9	2.1	Construction of buildings	Construction (F)	-7.6	-0.3	**4.8**	-11.5	-3.9	Higher staffing levels to meet stricter regulation. Labour/skills retention to avoid higher subsequent recruitment costs
1.1	2.2	Residential care activities	Health & social activities (Q)	-10.0	-0.2	**4.4**	1.5	11.5	NA
1.3	0.3	Electricity, gas, steam and air conditioning supply	Electricity, gas, steam and air conditioning (D)	-52.8	-0.2	**4.4**	-9.1	43.7	Staffing levels supported by investment in alternative energies / green initiatives. Change in business mix away from gas and electricity driven by greater awareness on part of customers to manage down energy costs. Labour/skills retention to avoid higher subsequent recruitment costs

Output weights (2007)	Employment weights (2007)	**Division**	**Sector**	**Productivity gap (%) relative to 2007**	**Contribution to aggregate productivity gap (pp)**	**% contribution to aggregate productivity gap**	**Output gap (%) relative to 2007**	**Employment gap (%) relative to 2007**	**Narrative**
2.8	2.1	Legal and accounting activities	Professional, scientific & technical activities (M)	-11.0	-0.2	**3.9**	2.8	13.8	Labour retention to avoid skills mismatch in light of training lags / 90s experience Change in business mix away from supporting risky FS activities. Tough trading environment: economic uncertainty led to project delays and higher average hours per project To some extent, higher staffing levels to meet stricter regulation.

Gaps calculated between 2007 and 2013Q4. For each division, the productivity gap is calculated by subtracting the employment gap from the output gap, while the percentage point contribution to the aggregate productivity gap is calculated by subtracting the employment gap times the employment weight from the output gap times the output weight. For any sector, when the output and employment weights differ markedly, the sector's contribution to the aggregate productivity shortfall may have a different sign than that sector's own productivity shortfall would imply (e.g. Financial & Insurance).

Source: ONS and author's calculations.
Output measured as sectoral Gross Value Added, available at http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-328821. Although the data are chain-linked, the annual chain-linking methodology introduced in 2003 means that sectoral estimates do not aggregate to published totals before the base year, which is currently 2010 (see 'The effects of annual chain-linking on the output measure of GDP'). As a result, the aggregate shortfall of 5.4% is not comparable with the expenditure-based aggregate published by the ONS. For employment, Workforce jobs data are scaled up by the Labour Force Survey.
A list of the UK Standard Industrial Classification of Economic Activities 2007 (SIC 2007) can be found here: http://www.businessballs.com/freespecialresources/SIC-2007-explanation.pdf

Table 3: Demand-contingent vs. non-cyclical narratives

Division	% contribution to aggregate productivity gap	Reweighted to 100%	Demand contingent	Demand contingent narrative	Non-cyclical	Non-cyclical narrative
Mining of coal and lignite; Extraction of crude petrol/gas	21.9	19.4	x		✓	Sector specific
Education	14.8	13.1	x		✓	
Financial service activities, except insurance and pension funding	13.4	11.9	x	Minimum operating scale Tough trading environment	✓	Change in business mix Regulation
Social work activities without accommodation	12.3	-	n/a		n/a	
Activities of head offices; management consultancy	11.1	9.8	✓	Minimum operating scale Tough trading environment Labour/skills retention	x	Change in business mix
Services to buildings and landscape activities	10.0	8.9	✓	Sector specific	x	
Warehousing and support activities for transportation	9.2	8.1	✓	Minimum operating scale Tough trading environment	x	Regulation
Postal and courier services	7.9	7.0	x	Tough trading environment	✓	Change in business mix
Wholesale trade, except of motor vehicles and motorcycles	6.1	5.4	✓	Minimum operating scale Tough trading environment Labour/skills retention	x	
Activities auxilliary to financial services and insurance activities	5.6	4.9	x	Minimum operating scale Tough trading environment	✓	Change in business mix Regulation
Construction of buildings	4.8	4.2	✓	Tough trading environment Labour/skills retention	x	Regulation
Residential care activities	4.4	-	n/a		n/a	
Electricity, gas, steam and air conditioning supply	4.4	3.9	x	Tough trading environment	✓	Change in business mix
Legal and accounting activities	3.9	3.5	✓	Minimum operating scale Tough trading environment Labour/skills retention	x	Change in business mix
Total	129.7%	100%	**39.8%**		**60.2%**	

Source: ONS and author's calculations (see footnote to Table 2).

Table 4: Demand-contingent vs. non-cyclical narratives weighted

Division	% contribution to aggregate productivity gap	Reweighted to 100%	Demand contingent	Demand-contingent weight	Demand contingent narrative	Non-cyclical	Non-cyclical weight	Non-cyclical narrative
Mining of coal and lignite; Extraction of crude petrol/gas	21.9	19.4	x	**0**		✓	**1**	Sector specific
Education	14.8	13.1		**0**		✓	**1**	Sector specific
Financial service activities, except insurance and pension funding	13.4	11.9	✓	**0.4**	Minimum operating scale Tough trading environment	✓	**0.6**	Change in business mix Regulation
Social work activities without accommodation	12.3	-	n/a	**0**	n/a	n/a	**0**	n/a
Activities of head offices; management consultancy	11.1	9.8	✓	**0.75**	Minimum operating scale Tough trading environment Labour/skills retention	✓	**0.25**	Change in business mix
Services to buildings and landscape activities	10.0	8.9	✓	**1**	Sector specific	x	**0**	
Warehousing and support activities for transportation	9.2	8.1	✓	**0.8**	Minimum operating scale Tough trading environment	✓	**0.2**	Regulation
Postal and courier services	7.9	7.0	✓	**0.2**	Tough trading environment	✓	**0.8**	Change in business mix
Wholesale trade, except of motor vehicles and motorcycles	6.1	5.4	✓	**1**	Minimum operating scale Tough trading environment Labour/skills retention	x	**0**	
Activities auxilliary to financial services and insurance activities	5.6	4.9	✓	**0.4**	Minimum operating scale Tough trading environment	✓	**0.6**	Change in business mix Regulation
Construction of buildings	4.8	4.2	✓	**0.8**	Tough trading environment Labour/skills retention	✓	**0.2**	Regulation
Residential care activities	4.4	-	n/a	**0**	n/a	n/a	**0**	n/a
Electricity, gas, steam and air conditioning supply	4.4	3.9	✓	**0.4**	Tough trading environment	✓	**0.6**	Change in business mix
Legal and accounting activities	3.9	3.5	✓	**0.75**	Minimum operating scale Tough trading environment Labour/skills retention	✓	**0.25**	Change in business mix
Total	129.7%	100%	**43.7%**			**56.3%**		

Source: ONS and author's calculations (see footnote to Table 2).

References

Arrowsmith, M, Franklin, J, Gregory, D, Griffiths, M, Wohlmann, E and G Young (2013), SME Forbearance and its implications for monetary and financial stability, Bank of England *Quarterly Bulletin*, 2013 Q4, available at http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2013/qb130401.pdf

Bank of England (2014), *Inflation Report*, February 2014, available at http://www.bankofengland.co.uk/publications/Documents/inflationreport/2014/ir14feb.pdf

Bank of England (2014), *Inflation Report*, May 2014, available at http://www.bankofengland.co.uk/publications/Documents/inflationreport/2014/ir14may.pdf

Barnett, A, Batten, S, Chiu, A, Franklin, J and M Sebastia-Barriel (2014), 'The UK productivity puzzle', Bank of England *Quarterly Bulletin* 2014 Q2, available at http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2014/qb14q201.pdf

Hackworth, C, Radia, A and N Roberts (2013), 'Understanding the MPC's forecast performance since mid-2010', Bank of England *Quarterly Bulletin* 2013 Q4, available at http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2013/qb130405.pdf

McCafferty, I (2013), 'Monetary policy in a changing economy', speech given at Bloomberg, London, 18 January, available at http://www.bankofengland.co.uk/publications/Documents/speeches/2013/speech627.pdf

McCafferty, I (2014), 'Slack, pricing pressures and the outlook for policy', speech based on remarks given in Northern Ireland, 1 April, available at http://www.bankofengland.co.uk/publications/Documents/speeches/2014/speech724.pdf

Broadbent, B (2012), "Productivity and the allocation of resources", speech given at Durham Business School, 12 September, available at http://www.bankofengland.co.uk/publications/Documents/speeches/2012/speech599.pdf

Miles, D (2012), "Monetary policy and the damaged economy" speech given at the Society of Business Economists Annual Conference, 24 May, available at http://www.bankofengland.co.uk/publications/Documents/speeches/2012/speech576.pdf