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Is the British economy supply constrained II? A renewed critique of productivity pessimism

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Key points

- The output of the British economy is some 14% below the level that it would have attained had growth continued at the pace seen before the banking crisis.¹ This suggests that there exists ample spare capacity to meet higher demand.
- After making allowance for various offsets, including deficiencies in the official statistics, the figure for the output shortfall could be put more conservatively at 9½%. There is a wide range of possible estimates, which depend crucially on the likely impact of the crisis on national productivity.
- Policy makers and others believe the crisis inflicted major structural damage with the result that national output may be only 2½% or so below its potential.
- Supply-side pessimists fear that capacity constraints could derail anything more than a modest revival of demand.
- For similar reasons, the Office for Budget Responsibility believes that Britain's budget deficit is mainly structural in nature, and will not disappear with recovery. The cyclical part of the budget deficit is put at about 2% of the economy's gross domestic product. We believe this estimate is too low. The true figure could be as high as 6%.
- Supply-side pessimists are at a loss properly to explain the causes of the alleged structural damage to the economy's capacity and productivity:
 - The shortfall in productivity is spread widely across industrial sectors and is not, as some claim, just the result of the collapse of finance or of North Sea oil production: shortfalls in these sectors can reliably account directly for about one tenth of the national productivity shortfall.
 - The shift in jobs away from higher productivity sectors towards lower productivity sectors accounts for a minor ¼ percentage point of the national productivity shortfall.
 - Lower business investment, including spending on research and development, and any loss of labour skills cannot plausibly account for the timing and alleged scale of capacity damage. There is no discernible shortfall in the ratio of national capital to labour. The proportion of workers receiving job-related training has recovered. A revival of demand could, in principle, make good losses so far inflicted.
 - The emphasis placed on the impact of a sclerotic banking system on the pace of innovation by credit-constrained small and medium-sized enterprises belies the quantitatively small role of SMEs in explaining innovation and productivity growth. Independent SMEs account for just 3½% of business R&D spending.

¹ The estimate is based on preliminary official data for the first quarter of 2012.

- The supply-pessimists' case is unpersuasive for other reasons:
 - It is wrong to assume that the persistent shortfall in output is necessarily supply-side driven. As a result of business and consumer self-feeding dependency, economies subject to large demand shocks can fall outside a normal corridor of stability and have no natural tendency to return.
 - The UK's poor inflation record since the start of the crisis is mainly due to import price shocks and should not be taken as evidence of inadequate capacity. Inflation has responded to unemployment and spare capacity in a feeble manner consistent with pre-crisis behaviour.
 - Widely used business survey evidence of capacity pressures is unreliable. Survey respondents' notion of capacity is not well defined and responds elastically to demand. Survey respondents "find" capacity when output rises sharply, and "lose" it when output slackens.
 - Differences in institutions rather than the forces stressed by supply-side pessimists more readily explain the diverse international experience: the comparative resilience of productivity in America and Spain and the widespread shortfalls in productivity seen elsewhere in Europe. It is no more likely now than it was in the Great Depression that economies have spontaneously succumbed to a form of technological regress.
- The UK's poor productivity is more plausibly interpreted as a symptom of a largely demand-constrained, cheaper labour economy - a condition misinterpreted by supply pessimists as a sign of structural weakness. Output is well below potential because workers, while cheaper to employ, are not working to potential. More output could be produced, but not sold. There is an effective demand failure, high unemployment and, within companies, under-utilisation of the employed workforce – a form of "labour hoarding".
- Members of the Monetary Policy Committee have asserted that under-utilisation of employed labour is inconsistent with the creation of private sector jobs seen since 2009. We refute this argument: it ignores the under-utilisation of *overhead* labour that firms require to stay in business even after they cut back *variable* labour.
- Lower real wages, a unique feature of the downturn, have helped to protect jobs by improving firms' chances of survival, by encouraging the hoarding of skilled labour and by promoting labour-intensive growth at the margin.
- The economy recovered in 2010 but disappointed in 2011. In those two years, around 550 thousand jobs were created in relatively low-productivity, low-paid largely private service activities that had less incentive than other activities to hoard labour during the preceding contraction and more to gain from the availability of cheaper labour. This expansion of jobs is another feature of a demand-constrained, lower wage economy.

Introduction and summary

Has Britain's economy been structurally damaged by the banking crisis and its aftermath? Policy makers think so – in spades. In their view, and in the view of many others, the contraction in 2008 and 2009 and the subsequent disappointing recovery came with, at best, negligible growth in the economy's productive capacity, if not outright loss. The result: a depressed economy with capacity limitations that could derail anything more than a modest revival of demand.

This view matters. The Office for Budget Responsibility, the fiscal watchdog, believes that most of Britain's budget deficit is structural, not cyclical, and would not disappear as the economy recovers. In the OBR's estimation, the economy's output gap – the difference between output and some notion of economic capacity – is negative, but small. The cyclical component of the budget deficit is thus also reckoned to be small - about a quarter of the total deficit. Such analysis provides part of the justification for the Government's rapid deficit reduction programme.

Monetary policy too is influenced by supply-side pessimism. Although prompted by renewed weakness of activity to agree to a relaxation of policy, members of the Monetary Policy Committee who had questioned Britain's economic potential were pressing for higher interest rates as recently as the summer of 2011; other members were on the cusp of joining them.² A revival of demand would be likely to reawaken calls for a policy tightening partly based on a gloomy assessment of the economy's capacity. The most pessimistic believe an increase in demand would serve largely to push up inflation.

The danger of excessive stimulus should not be ignored, of course. Britain's history is replete with examples of overly expansionary policy undertaken in the false belief that the economy had the capacity for rapid growth. The present authors were themselves strongly critical (when most were not) of expansionary demand management policy during past episodes of British growthmanship, such as the late-1980s Lawson Boom.

But a failure adequately to support demand also carries great risks. The longer demand deficiency persists, the more likely supply would be impaired, as investment falters, skills obsolesce and animal spirits dim. Official supply-side pessimism may systematically deprive the economy of required demand stimulus and so, ironically, cause considerable and lasting structural damage.

Fearing such damage, one of the present authors challenged the official orthodoxy in a study published last July.³ It was argued that the pessimists lacked a credible narrative to explain the alleged capacity shortfall. The reasons offered – loss of productive capital in various forms, loss of high-productivity sectors, risk-averse banks and so on – did not appear plausibly to explain why Britain's economic potential should have been damaged suddenly, severely and irreversibly. The identifiable damage was small and could be attributed to the impact of demand deficiency – the drop in investment, for example - in principle a temporary rather than permanent loss to the economy.

² Two current MPC members voted for an increase in bank rate up to, and including, the July 2011 interest-rate setting meeting. In June 2011, Weale (2011a) spoke to the theme "Why the Bank Rate should increase now". Bean (2012) notes the inclination towards tightening at the start of 2011.

³ Martin (2011a).

A demand-side explanation of events was offered instead. Aggregate demand, it was argued, had been depressed by the shortfall in world trade, hitting exports, and at home by an increase in desired private sector saving. The shock to demand was amplified and sustained by credit shortages, fiscal retrenchment and, in 2011, a worsening in Britain's international terms of trade, as import prices rose sharply.

Although a large drop in demand would normally come with a proportionately large rise in unemployment, it was argued (with no claim to originality) that the impact on jobs had been mitigated this time by a fall in real wages - wages relative to prices. Low wages had helped to cushion businesses' profitability and preserve jobs notwithstanding the shortfall in activity. As a result, much of the demand deficiency manifested itself in the form of low productivity, output per worker.

According to the demand-side explanation, poor productivity was a symptom of a largely demand-constrained, cheaper labour economy and not, as misinterpreted by supply pessimists, a sign of structural weakness.

This study brings that analysis up to date. A reassessment is opportune for several reasons. The economy has moved on, and so have official data and thinking. The Office for National Statistics has altered our understanding of the past with radical revisions to the figures for UK national output and its industrial composition. Previous arguments need to be re-examined through the lens of new data while steering through the inevitable statistical fog.

The official narrative has also changed. The OBR has downplayed old arguments but stuck to its pessimistic view. In its 2011 Autumn Statement forecast, the OBR noted, "Many of the channels that can be quantified more easily – such as the impact of the recession on capital per worker or the sectoral composition of the economy – appear to explain only a small proportion of the shortfall in productivity relative to its pre-crisis trend".⁴ This concession came, however, with a gloomier assessment of capacity developments. The OBR's Budget forecast repeated this message.⁵ The more cryptic Bank of England assessments suggest some softening in the official line: there is acknowledgement of the presence of "substantial spare capacity within the labour market", and, more recently, of "a modest margin of spare capacity within companies".⁶ There nevertheless also exists a pervasive pessimism about the economy's potential.⁷ A re-appraisal of the evolving official narrative is required.

In addition, careful consideration needs to be given to a key criticism levelled at the demand-side explanation. Supply-side pessimists argue that the expansion of private sector jobs since the winter of 2009 is inconsistent with the notion of widespread under-utilisation of the employed workforce. We refute this criticism and provide evidence that sheds new light on the co-existence of job creation and spare capacity.

⁴ OBR (2011b), paragraph 3.29.

⁵ OBR (2012), paragraphs 3.23 to 3.25.

⁶ Bank of England (2012b), p24 & p30.

⁷ For example, the August 2011 Inflation Report states that the MPC's "... central judgement is that the weak growth in productivity over the past three years largely reflects weak underlying productivity growth." (Bank of England (2011b), p43). The February 2012 Inflation Report concludes: "... the level of productivity is projected to remain significantly below a continuation of its pre-recession trend throughout the forecast period." (Bank of England (2012a), p44). The May 2012 Inflation Report is less explicit.

The conclusion drawn, as in the previous study, is that the economy is unlikely to be supply constrained to anywhere near the extent feared in official circles. That fear, insofar as it inclines officials towards endorsement of severe fiscal austerity – an exaggerated estimate of the size of the “structural” budget deficit - or early withdrawal of monetary stimulus, is potentially damaging. The pessimism risks a vicious spiral of weaker demand, weaker confidence and weaker supply.

This verdict comes with a caution. Rejection of the notion of near-binding capacity constraints and the presumption of a high level of spare capacity are not sufficient in themselves to justify advocacy of large-scale fiscal stimulus, or a “Plan B”.⁸ Britain’s still-vulnerable banking system represents a potentially important constraint on fiscal policy: to underpin confidence, the government needs to be in a position credibly to bail out systematically important banks.

The severity of this constraint, and the best way to respond, are matters beyond the bounds of this study.⁹ We simply observe that while banks remain vulnerable, the government may need to pursue a budget deficit reduction programme more severe than warranted by the imbalance between aggregate demand and aggregate supply.

Three chapters follow:

- *Rival views*:- contrasts consensus estimates of the output gap with those implied by an extrapolation of pre-crisis trends. Possible sources of difference are explored and tentatively quantified. A large difference of view remains, reflecting different interpretations of the economy’s productivity performance.
- *Productivity shortfall – demand-side explanations*:- considers the evidence for a sustained effective demand failure and the role played by low real wages in protecting jobs. The objection that the post-2009 jobs revival is inconsistent with the under-utilisation of labour is refuted.
- *Productivity shortfall – supply-side explanations*:- examines the case put by supply pessimists to explain an alleged severe, sudden and irreparable loss of productivity. The case is found to be unconvincing.

The study uses official UK data available to 16th May 2012. First quarter 2012 estimates are preliminary and based on partial information.

⁸ We thus differentiate our views from those of Corry et al. (2011) who also present an optimistic assessment of Britain’s productivity developments.

⁹ The Financial Policy Committee concluded at its March 2012 meeting that banks’ “ ... capital was not yet at levels that would ensure resilience in the face of prospective risks ...” (FPC (2012)). The government’s contingent liabilities in the form of explicit and implicit guarantees to the banking system are unlikely to be small. Those quantified in the latest Whole Government Accounts amount to about 12% of national income (HMT (2011)), but the WGA excludes implicit guarantees that, as recent simulations by the European Commission (2011) illustrate, could be many times larger. It is open to debate whether fiscal austerity mitigates the threat to stability arising from systemic banking fragility or makes matters worse: in attempting to assuage fears of sovereign default, an austerity programme may undermine confidence and increase the likelihood of private default.

Rival views

Britain's deep recession has been followed by an unusually weak recovery. According to a minority view, which we share, the economy has been left with abundant excess capacity. The majority view is that the economy has little capacity to spare. The two views are orders of magnitude apart. This chapter shows that the differences cannot be plausibly attributed simply to problems with the official statistics; nor do they generally arise because of radically different interpretations of the state of the labour market or the extent to which the economy was "above trend" prior to the crisis. The bone of contention is the amount of spare capacity *within* businesses and their productivity. We begin with a brief description of the recession and recovery before turning to the rival analyses.

Britain's disappointing recovery

According to the latest official statistics shown in Table 1, the economy contracted by 1% in 2008 and by 4½% in 2009. A trough was reached in the second quarter of 2009, and modest recovery ensued. The economy grew by 2% in 2010 but ceased to expand after the autumn. Growth in 2011 as a whole was a feeble ¾%, partly thanks to disruption of North Sea oil and gas production. But even with North Sea production taken out, the economy grew by only 1% last year.

At the beginning of 2012, the economy's gross domestic product in volume terms was still below the business cycle peak in the first quarter of 2008 and no higher than in the second half of 2010. Some had hoped for much better in the belief that a deep recession would naturally give rise to rapid recovery.¹⁰ These hopes have been dashed.

Table 1: Recession & recovery

GDP growth, % p.a.	2008	2009	2010	2011
UK	-1.1	-4.4	2.1	0.7
G20	2.3	-1.4	5.0	2.8
of which :				
US	-0.3	-3.5	3.0	1.7
Euro area	0.4	-4.3	1.9	1.5

Sources and notes: Office for National Statistics (ONS), US Bureau of Economic Analysis (BEA), International Monetary Fund (IMF), Organisation for Economic Co-operation and Development (OECD), Eurostat.

Britain's experience compares unfavourably with the global average. In the G20 group of countries, which includes the likes of Brazil, China and India as well as the more advanced economies, GDP was back to its previous peak level by early-2010, thanks to the rapid recovery of emerging economies. Even by mature economy standards, the UK recovery fell short. According to the latest estimates, GDP has matched or exceeded the pre-crisis peak level in America, Canada, Belgium, Germany, Norway, Sweden and Switzerland.¹¹ Other

¹⁰ Mussa (2009) attributes the idea of a natural rebound to the late Victor Zarnowitz, a business cycle historian. Martin (2010b) notes the division of opinion between those who thought output would eventually grow at a normal rate but at a permanently lower level (the "difference stationary" school) and those who thought output would snap back to the previous trend (the "trend stationary" school).

¹¹ Eurostat data were only partly available to 1Q 2012 at the time of writing.

European economies hit by a combination of banking and government debt crises fared very poorly. Even so, the failure of GDP to match the 2008 peak was more marked in the UK than in the Euro area as a whole.

Table 2: Major UK recessions

Contraction periods (Duration in quarters)	---- Change in GDP, % ----		GDP after trough* % of pre-contraction peak
	until trough	after trough*	
2008 and after (5)	-7.1	3.0	-4.3
Post-war before 2008: simple average (6¼)	-3.5	7.9	4.1
of which:			
early-1990s (5)	-2.5	6.5	3.8
early-1980s (5)	-4.7	8.4	3.3
mid-1970s (9)	-3.3	8.8	5.3
Memo:			
early-1930s (6)	-7.6	10.0	1.6

Sources and notes: ONS, Central Statistical Office Cyclical Indicators (discontinued); Birchenhall et al. (2001); Mitchell et al. (2009); authors' calculations. * 11 quarters after trough. The quarter periods marking the cycle peaks and subsequent troughs are taken to be 1Q 1930 and 3Q 1931 ("early-1930s"); 2Q 1973 and 3Q 1975 ("mid-1970s"); 4Q 1979 and 1Q 1981 ("early-1980s"); 2Q 1990 to 3Q 1991 ("early-1990s"); 1Q 2008 and 2Q 2009 ("2008 and after"). The ONS dating of the early-1990s trough has varied; the choice of 3Q 1991 has been changed from the one used in Martin (2011a) to align with current practice. Official GDP data prior to 1997 is subject to a discontinuity, implying a probably small understatement of growth.

Britain's recovery also appears unusually weak when set in historical context. Table 2 shows the scale of contractions and subsequent recoveries in the present cycle and during and after Britain's major recessions, which occurred in very different inflationary circumstances, in the mid-1970s, early-1980s and early-1990s.¹²

The 3½% average fall in output from cycle peak to trough in previous recessions is markedly less than the 7% contraction that occurred between the peak in the first quarter of 2008 and the trough in the second quarter of 2009. The scale of the current recovery is also weaker measured over a comparable period from each cycle trough: today's 3% is less than half the average GDP recovery seen in previous episodes. By that reckoning, the level of output should be by now comfortably above its business cycle peak. The current recovery is also weak judged by the standards of the 1930s; contrary to popular impression, recovery in that episode was comparatively vigorous.

The metric set by cycle comparisons is straightforward but hardly ideal. Cycles differ and the dating of peaks and troughs is open to debate. A more demanding measure is provided by the gap between output and its potential or trend level. Unlike the historic comparisons, which evaluate output in relation to the pre-recession peak, the output gap measures the severity of recession and the strength of recovery against a baseline that grows in line with the economy's productive potential. Trend output is, alas, unobservable and none of the many methods of estimation can claim superiority.

¹² The choice of quarter periods to denote peaks and troughs is open to debate. The dating used in Table 2 is informed by an examination of the path of GDP, cyclical indicators and econometric evidence.

Table 3: Output gaps – simple trend extrapolation

Gap, % of trend output	2009	2010	2011	4Q 2011	1Q 2012
GDP	-10.2	-10.8	-12.6	-13.5	-14.2
Memo: Gross value added					
Market sector	-12.4	-12.9	-14.3	-15.2	n.a.

Sources and notes: ONS, authors' calculations. The output gap is defined as actual output less trend output, as a per cent of trend. The latter is set equal to actual output in 1Q 2008 and mechanically extrapolated using the average rate of growth over the preceding seven-year period. Whole economy gross value added is an indicator of activity derived from sectoral outputs and measured, unlike GDP, at basic prices (market prices net of taxes less subsidies on products). Market sector GVA comprises whole economy GVA less government administration, defence, education, health, social work and community services, and the housing rents imputed to owner-occupiers (Herbert and Pike (2005) give details).

A useful benchmark is offered in Table 3. It depicts trend output by mechanically extrapolating GDP from the cycle peak at the rate of growth achieved in the post-millennium, pre-crisis period. This growth rate is close to the post-war pre-crisis average, taken to be 2¾% a year.¹³ The working assumptions are that the economy was on-trend at the peak and that the recession caused no lasting damage to potential.

On this arithmetic, the shortfall in GDP (negative output gap) has continued to rise for the simple reason that growth has not consistently exceeded the previous trend. By the end of 2011, the economy-wide shortfall, expressed as a per cent of trend, was 13½%; the private sector¹⁴ shortfall was 15%. Preliminary figures put the national shortfall in excess of 14% in the first quarter of 2012. Such weakness, allied to the persistence of high unemployment, is symptomatic of stagnation rather than genuine recovery.

Pre-crisis boom and capacity stagnation?

While not disputing the weakness of activity, consensus opinion holds that the level of spare capacity is materially less than suggested by the calculations in Table 3. According to the OBR's latest comprehensive survey, the consensus estimate for the shortfall in GDP in 2011 was 2¾%, in line with the OBR's own figure and a fifth of the GDP shortfall calculated on the basis of the mechanically extrapolated trend.

Two broad reasons explain the difference of view. First, the consensus holds that the economy was operating above potential on the eve of the crisis, if not before, so that some of the subsequent contraction merely restored normality. Second, it is widely believed that productive capacity was damaged by the crisis. The claimed scale of prior excess and subsequent capacity impairment require further consideration.

¹³ Average GDP growth is 2.6% a year between 1949 and 2007 according to the official data, but it is reasonable to add a ¼ percentage point guesstimate to allow for the methodological discontinuity that occurs in 1997. For the 2011 Blue Book, the ONS replaced the retail price index with the consumer price index as the preferred price measure to convert nominal output and expenditure series into measures of volume. This change, detailed in Drew (2011), has so far been taken back to 1997. The ¼% point growth addition is partly informed by the 2011 Blue Book revisions to real GDP and the GDP deflator (see OBR (2011b), paragraph 2.10). Martin (2011a) uses 4Q 2007 rather than 1Q 2008 as the starting point of the mechanical trend extrapolation. Although the banking crisis was well underway by early-2008, the choice of 1Q 2008 facilitates comparison with official practice.

¹⁴ Strictly speaking, the "market sector", which includes the activities of public corporations.

Estimates vary of the output excess at the business cycle peak. Based predominantly on a statistical examination of business survey evidence, the OBR puts the output gap in the first quarter of 2008 at 1½%. An alternative measure calculated by the OBR indicates an output gap of 1%.¹⁵ Remarks by the Bank of England’s Chief Economist Spencer Dale suggest an estimate of similar size for the private sector as a whole.¹⁶

Setting aside concerns about the use of business survey evidence, these estimates of initial excess are too small to have anything but a very modest impact on the estimated scale of current spare capacity. An allowance for an output gap of 1½% at the cycle peak would reduce the mechanically estimated GDP shortfall in the first quarter of 2012 from 14¼% to 13%.¹⁷

Larger estimates of initial excess exist, however. The feebleness of the recovery has prompted a re-appraisal of the balance of supply and demand before the crisis hit home. Previous estimates of the output gap have been revised up, as Table 4 illustrates. The average output gap estimate offered by international agencies for 2007 has risen from close to zero at the time to 3% now.

Table 4: Output gaps in 2007

Output gap % of trend GDP	----- 2007 -----	
	Original estimate	Latest estimate
EC	-0.1	3.6
IMF	0.2	2.2
OECD	0.4	3.2
Memo:		
Average EC, IMF, OECD	0.2	3.0

Sources and notes: authors’ calculations, European Commission (EC) - European Economy Economic Forecast, Autumn 2007 and European Economic Forecast, Spring 2012 (May); IMF - World Economic Outlook, October 2007 and April 2012; OECD - Economic Outlook, December 2007 and November 2011.

This re-write of history is partly a figment of the way these agencies, and others, rely on sophisticated statistical “filters” to calculate capacity. (A moving average is an example of a simple filter.) The collapse in output after 2007 drags down a filter-estimated trend after but also *before* the start of the crisis, thus elevating output relative to trend in the pre-crisis period. This weakness in the method of estimation is well known and formally referred to as the “end-point problem”.¹⁸

¹⁵ The OBR uses two approaches to estimate the gap: “aggregate composite”, which combines business survey evidence, and “principal components”, which combines survey and non-survey indicators. Most of the non-survey indicators listed in OBR (2011a) have been dropped – see Pybus (2011).

¹⁶ Dale (2011) suggests that above-capacity working may account “for around a further 1% point of the [private sector] productivity shortfall”, calculated by trend extrapolation from 1Q 2008.

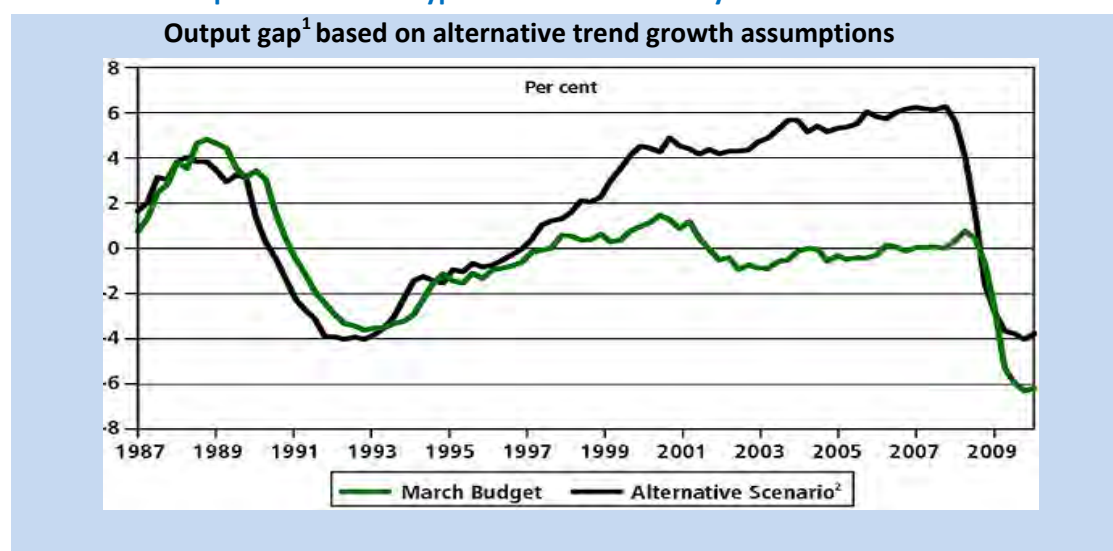
¹⁷ The impact of an initial output gap of 1.4% in 1Q 2008 – the OBR estimate - declines by 1Q 2012 to 1.2 percentage points as output falls below the, assumed given, extrapolated trend.

¹⁸ OECD (2009) gives a brief technical discussion.

Official revisions have made the problem worse. Output growth has been revised up before but not after the crisis, creating an even larger pre-crisis gap between GDP and the filtered trend.¹⁹ The impression is created of a booming economy, one likely to generate more inflation. Yet the upward revisions to pre-crisis real GDP came as a result of downward revisions to the level of economy-wide prices.

Although partly the result of estimation problems, such upward revisions appear to give support to a more extreme view of the pre-crisis economy. Writing in 2009 before becoming OBR Chairman, Robert Chote hypothesised that the economy may have run in pre-crisis years consistently above potential, with inflation held down by favourable global developments.²⁰ On this view, output may have been 3% to 4% above potential between 2000 and 2007. A similar calculation by HM Treasury in the June 2010 Budget, replicated in Chart 1, put output 4% or more above trend through the same period, rising in 2007 close to a 6% excess.²¹ The IMF staff report on the UK in 2011 similarly posited that unemployment might have fallen well below a structural level, implying a persistent pre-crisis output gap of 3% or more.²²

Chart 1: The pre-crisis boom hypothesis – HM Treasury calculation



¹Actual output less trend output as a percentage of trend output. Non-oil GVA basis

²Alternative scenario based on output gap of around -4 per cent at the end of 2009 and long-run average growth rate of 2.3 per cent

Source: HM Treasury

¹⁹ As an example, the revisions raise the 4Q 2007 GDP output gap estimated over the 1Q 1997 to 1Q 2010 interval using the popular Hodrick-Prescott filter by 1¼ percentage points.

²⁰ Chote (2009). For a similar view, see Sentance (2008).

²¹ HM Treasury (2010b), Box 1.4. It cites, in support, the elevated OECD output gap estimate without reference to the end-point estimation problem.

²² IMF (2011), p21.

The boom interpretation of economic developments prior to the crisis is open to an obvious objection: where was the inflation? Even allowing for the limited response of inflation to domestic capacity utilisation, it would be difficult to imagine an economy experiencing so many years of large positive output gaps – on the Treasury’s alternative calculation, greater than seen during the Lawson Boom – without an inflation problem emerging. Moreover, the influence of world inflation, as exerted through import and export prices, was rather less favourable in the 2000 to 2007 interval than during the second half of the 1990s. The putative inflation-dampening impact of imports from China, a frequently cited influence, was also overrated.²³

Favourable aspects of Britain’s pre-crisis supply-side performance should also be recalled. As documented by John Van Reenen and others,²⁴ the UK’s growth adjusted for population in the decade to 2007 was higher than that in other major mature economies, driven by strong growth in productivity, where the UK was second to the US, and by a rising proportion of the population in employment. Nor was productivity growth mainly the result of unsustainable bubbles in sectors such as finance and property. Van Reenen and his co-authors show that the biggest contributors to private sector productivity increases were the business services and distribution sectors.

The UK was also more successful than most European countries in exploiting the opportunities of information and communications technology, which made a notable contribution to pre-crisis productivity growth, comparable to that in the US. Taking a long historical perspective, Nicholas Crafts attributes these gains to the strengthening of competition in product and labour markets. Since “the 1970s stronger competition has been a key ingredient in ending relative economic decline.” Profitability was raised and rent-seeking reduced: the high pay-offs to ICT “would not have happened with 1970s-style industrial relations ... ”.²⁵ In these respects, the pre-crisis expansion was based on fundamental improvement.

It is nevertheless true that the expansion was unsustainable. The primary causes were a sequence of asset price bubbles – the American-led equity price bubble in the late-1990s, the subsequent global property price bubble - and the associated build-up of private sector debt, notably by banks.²⁶ The key problem was one of inflated balance sheets and excess borrowing which, unlike in a traditional boom, did not lead to a material excess of aggregate demand over supply.

In short, the contentious big boom-bust story fails to convince. The more modest OBR estimates of output excess at the business cycle peak are too small to explain more than a percentage point or so of the large difference between the consensus view of the GDP shortfall and the alternative view consistent with the continuation of pre-crisis trend growth.

²³ Wheeler (2008) finds the switch to imports from China lowered UK inflation, an effect offset by a higher rate of inflation of the prices of exports from China than from other UK trading partners. On balance, the author finds “the overall effect of Chinese imports on UK CPI inflation from 1997–2005 was positive.” – that is, UK inflation was raised, not lowered.

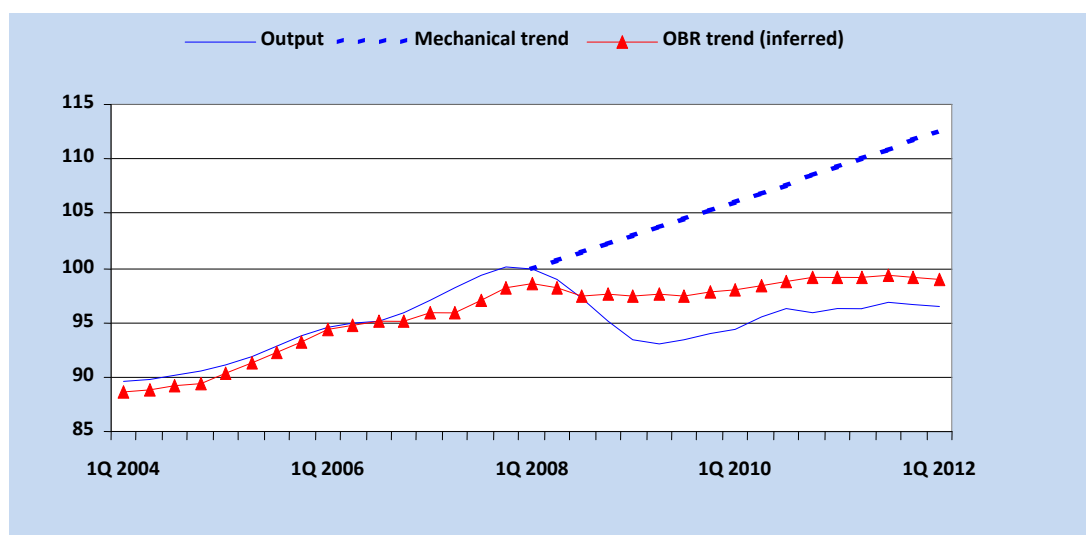
²⁴ Corry et al. (2011).

²⁵ Crafts (2011).

²⁶ Martin (2010a) provides a detailed description.

The main reason for this difference in views lies elsewhere: in the consensus belief that economic capacity has been permanently impaired. The series shown in Chart 2 provide a useful representation. The chart compares output with a mechanically extrapolated trend and a level of capacity inferred from the OBR's consensus-like figures for the output gap and other gap estimates derived using a similar method. The series refer to the onshore economy – the total less North Sea oil and gas extraction - but the distinction between the onshore and the whole economy is of no consequence.

Chart 2: Onshore output and representations of trend capacity



Sources and notes: ONS, OBR (2012), Pybus (2011). Output refers to the ONS measure of the volume of whole economy Gross Value Added excluding oil and gas extraction (“onshore output”). The OBR figures are the authors’ inferred from onshore output and the OBR’s official output gap estimates beginning 2008. The output gap figure used for 1Q 2012 is the OBR forecast (-2.5%). Before 2008, the output gap is taken as a weighted average of Pybus’s (2011) two output gap series. Trend output (X) is derived from the level of output (Y) and the

output gap (Ω) using the identity: $X \equiv \frac{Y}{1 + \Omega}$. The inferred quarterly data using the vintage of official output

statistics available to the OBR align with the annual potential output series in OBR (2012), Chart 3.4. The inferred estimates have been updated to reflect revised official onshore GVA data. Mr Pybus generously made available his revised historical output gap estimates, but he is not implicated by our interpretation of his data.

On this reckoning, economic capacity contracted between the peak in the first quarter of 2008 and the trough in 2009, and subsequently recovered modestly, growing by 1½% over the year to the final quarter of 2010. Thereafter, there was no growth; indeed capacity fell slightly. Economic capacity by the first quarter of 2012 was hardly any higher than four years earlier, and had fallen short of the extrapolated pre-crisis trend by over 10%.²⁷

²⁷ OBR (2012), paragraph 3.26 cites a slightly smaller capacity shortfall of around 8% in 2011 as a whole based on a pre-crisis trend growth rate over the five-year interval to 1Q 2008 of 2.7% a year. We use a 3% annual average trend growth rate based on a seven-year interval up to the cycle peak.

The scale of the imagined capacity shortfall is remarkable. The loss would put it on the same footing as a major natural disaster.²⁸ Also striking is the suddenness of the claimed impairment to capacity expansion, coincident with the recession. As the OBR documents, it is not alone in regarding the damage as irreparable. Even though the OBR assumes a slow return to a modest trend growth rate of 2¼% a year, projected capacity in five years time falls short of the extrapolated trend by no less than 14%.

The differences between the extrapolated trend and the consensus-like capacity estimates may arise for several reasons. The probably minor impact of output excess at the business cycle peak has been discussed. In the remaining sections, we consider other sources of difference: different views about the amount of slack in the labour market, different views about productivity, and the impact of any bias in the statistics. This process of elimination identifies productivity as the main bone of contention.

Output gap decomposition

Differences of opinion about the labour market and productivity can be crystallised using a simple piece of accounting. As a matter of identity, output is equal to the number of workers multiplied by output per worker, the former dependent on the rate of unemployment and the size of the labour force. The output shortfall can therefore be split between shortfalls in employment and shortfalls in productivity.

Table 5 shows this decomposition for the output gap based on a mechanical extrapolation of the pre-crisis trend while Table 6 shows the comparison with the OBR's latest figures and what may be plausibly inferred from them.

Table 5: Output gap, productivity gap & unemployment

%, unless stated	2009	2010	2011
GDP output gap	-10.2	-10.8	-12.6
of which:			
Employment gap:	-3.1	-3.8	-4.2
of which:			
Labour force gap	-0.6	-1.0	-1.2
Increase in unemployment rate (% pts, reverse sign)	-2.4	-2.7	-2.9
Productivity gap (output per worker)	-7.1	-7.0	-8.5
Memo: alternative measures of productivity gap			
Output per job	-7.3	-7.2	-8.8
Output per hour	-5.9	-6.0	-7.2

Sources and notes: ONS, authors' calculations. GDP gap – see notes to Table 3. Each gap expresses the difference between the prevailing level and a trend, expressed as a per cent of trend. The trend levels of output, employment and productivity are extrapolations of the 1Q 2008 levels using the average rates of growth over the preceding seven years. The labour force is the sum of the Labour Force Survey (LFS) measures of employed workers and the unemployed, centred on the three-month LFS quarter period. The increase in the unemployment rate - unemployment as a per cent of labour force – is calculated by reference to the level in 1Q 2008. The trend labour force is the quotient of trend employment and one minus the 1Q 2008 proportionate rate of unemployment. Output per worker, per job and per hour are the official estimates of whole economy real GVA per LFS worker, per LFS job (including workers with second jobs) and per LFS hour worked. The contributory gaps do not exactly sum to the GDP output gap because the underlying identity is multiplicative and the productivity measure uses the GVA rather than the GDP measure of output.

²⁸ Hochrainer (2009) puts the median GDP loss following a variety of natural disasters in a wide range of countries at a little over 2% four years after the event.

The decomposition in Table 5 attributes the rising output shortfall to shortfalls in both employment and in output per worker. About a third comes from employment and two-thirds from productivity. In 2011, an output shortfall of 12½% comprises a 4¼% shortfall in employment and an 8½% shortfall in output per worker.

As the table's memorandum item shows, the shortfall in productivity in terms of output per *hour* is somewhat smaller, thanks to a reduction in people's weekly hours of work. Average hours worked by full-timers and part-timers have not changed much on balance since the cycle peak. The overall fall in average weekly hours largely reflects the increasing share of employment that is part-time:²⁹ the average hours of part-timers are less than half those of full-timers. Total hours worked across the economy – the product of average weekly hours and the number of jobs - have therefore fallen by more than the number of jobs, implying a smaller shortfall in hourly productivity. Since it does not materially affect our main analysis, the distinction between output per worker and output per hour is not pursued further.

Table 5 goes on to divide the employment shortfall into two components: the impact of the rise in unemployment and the effect of changes in the available labour force. At 8%, the unemployment rate in 2011 was about 3 percentage points above the pre-crisis average: this jump accounts for the bulk of the 4¼% shortfall in employment.

The other 1¼ percentage points comes from the shortfall in the labour force – the sum of the employed and unemployed. The labour force has grown since the business cycle peak, but more slowly than before the crisis, a deceleration that came despite the continued expansion of the adult population, still growing at about ¾% a year.

The labour force shortfall reflects instead a reduction in labour market participation: the proportion of the adult population in work or seeking it. The rate of participation has declined modestly since the cycle peak and more significantly compared with the previous mild upward trend. Before the crisis, there had been divergent trends across gender (the participation rates of women rising, those of men falling), and since the latter half of the 1990s across ages (the participation rates of young adults falling, those of the over-fifties rising). After 2007, participation rates of younger adults fell sharply but those of others increased, albeit for the over-fifties not as quickly as before.

The resulting shortfall in the labour supply in 2011 was equivalent to an increase in disguised unemployment of around 400 thousand, a figure that receives partial support from the increased number of people who say they want a regular job but who are not counted as unemployed.³⁰

²⁹ Compared with the position at the business cycle peak, part-time employment is now substantially higher, having grown at a rate in excess of the pre-crisis trend, whereas full-time employment has contracted substantially, declining at about the same pace at which it had previously grown.

³⁰ Respondents to the Labour Force Survey who say they would like a regular paid job at the moment but are not counted as unemployed, having not looked for work in the last four weeks and, or, being unable to start work within two weeks. It is difficult to define a pre-crisis average: the number of people in this category declined between 2002 and early-2005, rose modestly in the following year and then stabilised. Between 2007 and 2011, their number rose by 130 thousand.

Table 6 compares these estimates, based on the mechanical extrapolation of pre-crisis trends, with the latest OBR decomposition. The OBR provides a regular decomposition of its output gap figure but described in terms of productivity, the employment rate (the proportion of the adult population in employment), and population. Table 6 translates that presentation using subsidiary information published by the OBR to enable comparison with the approach taken in Table 5. Figures relate to the onshore economy in the final quarter of 2011.

Table 6: Gap decomposition: simple extrapolation v OBR (partly inferred)

%, unless stated, 4Q 2011	simple	OBR
Onshore GVA output gap	-13.5	-2.5
of which:		
Employment gap:	-4.7	-1.9*
of which:		
Labour force gap	-1.4	1.4**
Increase in unemployment rate (% pts, reverse sign)	-3.2	-3.0**
Productivity gap (output per worker)	-9.2	-0.6
Memo: other gaps		
Onshore output per hour	-8.5	-0.4
Average weekly hours	-1.1	-0.2
Onshore output per job	-9.5	n.a.

Sources and notes: ONS, authors' calculations, OBR (2012): paragraph 3.22 & Table 1.4 Labour Market, Economy Supplementary Tables. See notes to Table 5. *calculated from ONS estimate of LFS employment and OBR estimate of trend employment. ** inferred from LFS data and OBR estimates of trend employment and of the "long-term" Non-Accelerating Inflation Rate of Unemployment (NAIRU) of 5.35%. The qualification that the assumed NAIRU is "long-term" in nature appeared in the OBR's November 2011 forecast. The assumption is used by the OBR to project potential output, currently from 1Q 2012. We assume the same NAIRU applies to the 4Q 2011 decomposition of the OBR output gap. We calculate onshore output per hour, per worker and per job by dividing onshore GVA by ONS indices of whole economy hours, workers and jobs; ONS data on jobs in the oil and gas sector are no longer published. Average weekly hours are consistent with ONS indices for output per hour and output per job. The OBR calculates onshore output per hour by dividing onshore GVA by whole economy total weekly hours worked. The implied differences between our and the OBR measures of average weekly hours are trivial.

Several features stand out:

- The difference in estimates of output shortfall is massive: 13½% versus 2½%.
- Of this 11-percentage point difference, much the greater part reflects vastly divergent estimates of the shortfall in output per worker: 9¼% versus ½%.
- The divergence between estimates of the shortfall in employment is comparatively small: 4¾% versus 2%.
- The OBR's arithmetic implies that the labour force is currently *above* trend.
- The different estimates of the impact of the rise in unemployment and of the shortfall in average hours worked are comparatively close.

Labour market slack

This comparison identifies productivity as the main source of difference. However, the amount of slack in the labour market also warrants consideration. The OBR's assessment of the labour force gap is puzzling. Moreover, there are justifiable concerns that high unemployment may become entrenched; the OBR may be too optimistic in its belief that structural unemployment has not increased since 2008.

As regards the labour force, it might normally be expected that recession would depress the rate at which people participate in the labour market: a discouraged worker effect. A cyclically-depressed rate of participation is clearly evident today amongst young adults, if not amongst the over-fifties. The simple estimates of the labour force gap shown in Table 6 are consistent with this interpretation of events.

Not so the implied OBR figure, which shows the labour force to be 1½% above trend in the final quarter of 2011. As noted in the previous study of productivity pessimism,³¹ the OBR's assumptions imply an implausibly low trend rate of participation. So low, in fact, that the OBR's arithmetic implies that the actual rate of participation is *above* trend rather than below it: an encouraged worker effect.³²

This feature explains why the OBR's estimate of the shortfall in employment is less than the impact of the rise in unemployment. The OBR's employment shortfall estimate is also less than the OBR's output shortfall estimate, leaving a residual that can be attributed to cyclically-depressed productivity. But were more credible estimates made of labour market participation, the employment shortfall would exceed the OBR's estimate of the output shortfall, and imply that sickly productivity was bizarrely above trend.

One inference is that the OBR's estimate of the output gap is too low: the minimum output shortfall should be set with regard to the amount of labour market slack. If the simple estimates in Table 6 are a guide, the lower bound in the final quarter of 2011 was 4¾%. However, both the simple estimates and the OBR's are open to the challenge that the level of structural unemployment may have risen. If so, some of the jump in the unemployment rate should not be counted as part of the output gap.

There are several reasons why structural unemployment might have increased. Dislocation and recession may have led to sectoral and geographic mismatches between jobs and job seekers. Workers displaced from contracting sectors such as government, finance and real estate may not be immediately re-employable in recruiting sectors, like basic business services. In addition, people's ability to move to new jobs may have been compromised by the fall in house prices and limited supply of mortgages.³³ However, various studies have been unable to detect significant increases in sectoral or geographic mismatches.³⁴

³¹ Martin (2011a), p28.

³² The OBR's trend employment rate of 59.2% in 4Q 2011 divided by one minus the rate of structural unemployment, taken to be 5.35%, implies a trend rate of participation of 62.5%. A rate as low was last seen in the late-1990s. The implied OBR trend participation rate is ¾ percentage point below the actual rate and 1½ percentage points below the level consistent with the mild pre-crisis uptrend.

³³ The Financial Services Authority estimated that nearly half the borrowers who had taken out mortgages between early-2005 and end-2010 would have been unable to re-mortgage in early-2011 and that up to 15% could have been in negative equity, with an outstanding mortgage in excess of the value of their property (FSA (2011)).

³⁴ See, for example, OBR (2011b), Chart 3.29; OECD (2011), Figure 7.

A second possibility is that changes in taxes and benefits might have discouraged the unemployed from seeking work. In the United States, some commentators have controversially pinned a large estimated increase in structural unemployment on the significant lengthening of the period of time during which claimants in many states could receive unemployment benefit.³⁵ No such controversy has occurred in the UK, however. Comprehensive, albeit somewhat dated, measures of changes since 2007 in effective marginal tax rates suggest little aggregate impact on the incentive of the unemployed to seek work.³⁶

A third possibility is that higher rates of long-term and youth unemployment have already caused increased detachment from the workplace and the erosion of skills: part of the self-perpetuating process of joblessness often referred to as “hysteresis”.

Both long-term and youth unemployment rates have increased substantially. At the beginning of 2012, the number of people unemployed for more than twelve months represented 2¼% of the total labour force, 1½ percentage points in excess of the rate four years earlier. Unemployed adults under the age of 25, including those in full-time education, numbered one million, equivalent to 3¼% of the total labour force, up 1 percentage point over four years. There is evidence from previous recessions that a spell of unemployment while young significantly damages individuals’ future employment and wage prospects;³⁷ although their increased resort to higher education to avert the risk of immediate joblessness may have beneficial future pay-offs.³⁸

The extent to which national unemployment may *already* have risen structurally for such reasons is unknown. The OBR’s judgement on these matters has not changed, but the relationship between job vacancies and unemployment – popularly known as the Beveridge Curve – hints that some rise in structural unemployment may have occurred. As Chart 3 records, vacancies fell and unemployment rose sharply as the economy contracted; but this inverse relationship weakened subsequently. A crude statistical test suggests unemployment at the turn of the year could have been around 200 thousand higher than might have been expected given the level of vacancies, equivalent to an increase in the unemployment rate approaching ¾ percentage point.³⁹

³⁵ The limit was raised from the regular 26-week period to as many as 99 weeks. Estimates of the impact on the unemployment rate vary considerably. Grubb (2011) argues that the impact of the time extension and related measures caused the US unemployment rate to increase by as much as 2 percentage points by end 2010. Rothstein (2012a) puts the impact in early 2011 at ¼ percentage point.

³⁶ See Adam and Browne (2010) and the OECD’s main tax-benefits indicators at http://www.oecd.org/document/3/0,3746,en_2649_33729_39617987_1_1_1_1,00.html. The Government intends that the introduction of its Universal Credit scheme will sharpen work incentives.

³⁷ See, for example, Gregg (2001), Gregg and Tominey (2004).

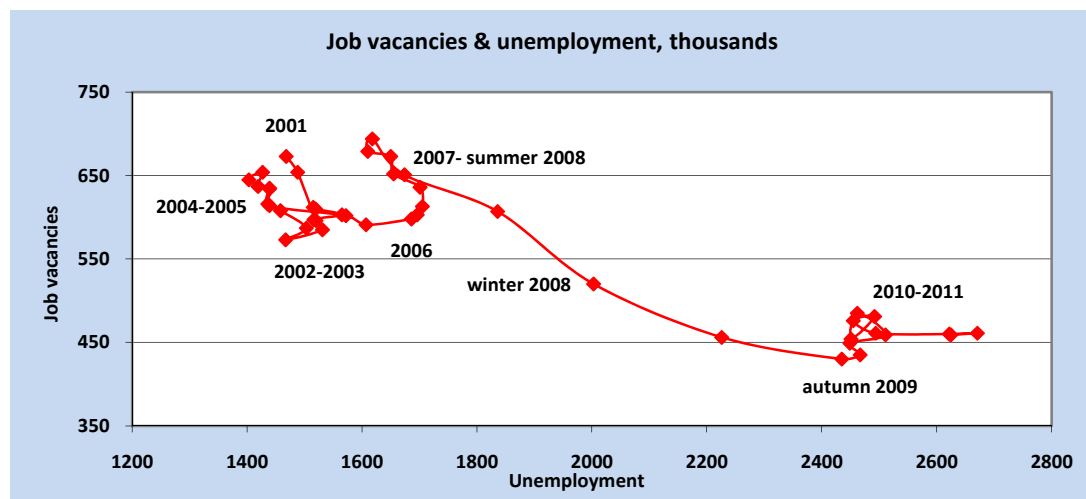
³⁸ The number of under-25s who are unemployed and seeking work but also in full-time education has risen in four years by over ¼ percentage point as a share of the total labour force.

³⁹ Inferred from the residuals of a standard regression relating unemployment to a constant, the level of vacancies and the level of vacancies squared.

In the US, a number of commentators have pointed to an outward shift in the Beveridge Curve as a sign of an increased rate of structural unemployment.⁴⁰ However, there are a several difficulties of interpretation: the presumption that it is a curve, rather than a straight line, impedes identification of a shift when unemployment is high; vacancies may typically respond more rapidly than unemployment when the economy starts to recover; and job offerings might be filled less quickly if employers choose to take time to seek out cheaper labour, or better skilled labour for the same offered wage.⁴¹ The apparent shift may thus be temporary. As the National Institute of Economic and Social Research notes, an improvement in the efficiency with which job seekers are matched with vacancies may well have to await a resumption of economic growth.⁴²

The answer to the question posed earlier is that the structural rate of unemployment may be a little higher than the OBR assumes, but the evidence is not yet compelling. As a result of high cyclical unemployment and a depressed rate of labour market participation, it seems likely that there exists considerable labour market slack materially greater than implied by the OBR's estimates.

Chart 3: Beveridge Curve



Sources and notes: ONS LFS and Vacancy Survey, with matched dates.

Data doubts

There is a final preliminary issue that requires attention: the quality of the official statistics. Part of the large shortfall in output measured against the historic trend may be a figment of unreliable data. Activity may have been underestimated. Productivity may have been further under-estimated because of an over-estimate of employment.

⁴⁰ See, for example, Weidner and Williams (2011).

⁴¹ See, for example, Tasci and Lindner (2010), Rothstein (2012b).

⁴² Kirby (2012).

Both possibilities could be plausibly entertained a year ago. A major re-statement of the official National Accounts was expected to lead to upward revisions to recent estimates of GDP in line with the long-term historical tendency. An alternative measure of employment, based largely on information from businesses' payrolls, indicated far less post-2009 job creation than shown by the Labour Force Survey of households; the alternative source was based on improved survey methods that were expected to mitigate the previous tendency for payroll jobs estimates to be revised up.

Neither expectation was borne out, however. Substantial upward revisions were made to GDP – but to years *before* the crisis. Growth in 2008 was revised down, although offset by upward revisions to growth in 2009 and 2010, leaving little net impact. Despite the overhaul of methodology, the payroll jobs figures were revised up. In addition, recent figures leave the payroll record of net job loss since early-2008 little different from that shown by the officially preferred, more reliable Labour Force Survey, albeit with a different profile during the periods of contraction and recovery.

Details of data weaknesses are given in an appendix, which also explores possible biases to the GDP figures resulting from the measurement of banks' output and, more generally, the changing importance of different sectors' output for growth of the overall economy. Neither of these sources of bias turns out to be of any significance, but there remain reasons to suppose that GDP figures underestimate recent activity.

Taking the historical pattern as a guide, Table 7 shows the impact on growth and on the mechanically estimated output gap of possible GDP revisions, which could take many years to appear. Also included is an allowance for the impact of the exceptionally cold 2010 winter and other erratic factors. The adjusted estimates of annual GDP growth in recent years are between a quarter and a half percentage point in excess of the official record, with a cumulative effect on the level of GDP in 2011 of 1¼%. There is a smaller impact on the output shortfall in 2011, which is reduced by about 1 percentage point to 11¾%.⁴³

The inference is straightforward: revisions would have to be quite exceptional to account for much of the shortfall in output relative to its pre-crisis trend.

Table 7: GDP growth and gap with allowance for possible revisions

GDP growth & gap based on:	---- Growth, % p.a. ----		Gap, % (based on extrapolated trend)	
	2010	2011	2010	2011
Official data	2.1	0.7	-10.8	-12.6
Adjusted data*	2.5	1.0	-10.2	-11.7

Sources and notes: ONS, Martin (2010a), authors' calculations. See notes to Table 3. * incorporates allowance for the long-term pattern of upward GDP revisions (see Martin (2010a)) and ONS estimates (-0.5%) of the impact of the unusually cold weather in 4Q 2010 and of the royal wedding and other factors in 2Q 2011.

⁴³ The impact on the gap is smaller than the impact on GDP for two reasons: the impact depends on the size of the gap and the allowance for revisions stretches back many years, albeit with diminishing effect. The result is a small revision to the level of GDP in 1Q 2008 from which the pre-crisis trend is extrapolated. Any effect of revisions on the estimated pre-crisis trend rate of growth is ignored.

Dale's differences

In summary, a gulf separates estimates of the output gap based on simple trend extrapolation and the consensus view. A number of preliminary reasons for this difference have been considered: the state of the economy at its peak, when output may have been mildly above trend; an increase in structural unemployment, where the evidence is suggestive but hardly compelling; and the possible downward bias of recent official GDP data.

In his speech in September 2011, Spencer Dale provided a guide to the likely magnitude of these and other differences. Although open to challenge, Dale's method provides a useful way of crystallising the debate and, in that spirit, Table 8 traces the impact of various factors on the size the GDP shortfall in the first quarter of 2012.

Making allowance for a modest initial output gap at the peak, for some increase in structural unemployment and for possible upward revisions to the official statistics, the mechanically estimated GDP shortfall is reduced from 14¼% to 11¼%. Also shown is the effect of a ½ percentage point reduction in the assumed annual trend rate of growth, a reduction which might be partly justified were output indeed above trend at the cycle peak.⁴⁴ The combined impact reduces the output shortfall to 9½%.

Table 8: Accounting for output gap impacts

Estimate	Assumptions				GDP output gap 1Q 2012 %
	Trend Growth % p.a.	Initial gap %	GDP revision 1Q 2012 %	Structural unemployment rate, %	
Baseline	2.8	0	0	5.2	-14.2
Variants:					
1	2.8	1.4	0	5.2	-13.0
2	2.8	1.4	1.5	5.2	-12.0
3	2.8	1.4	1.5	6.0	-11.2
4	2.3	1.4	1.5	6.0	-9.6

Sources and notes: authors' calculations. Baseline - see notes to Table 3. Variants are the cumulative effect of incremental changes: (1) output gap set at 1.4% in 1Q 2008 in line with OBR estimate; (2) level of GDP in 1Q 2012 and 1Q 2008 raised by 1.5% and 0.2% respectively to allow for revisions; (3) structural rate of unemployment raised to 6% by 1Q 2012 cf. 5.2% baseline and OBR's 5.35%; (4) trend growth rate reduced by 0.5 percentage point to align with OBR's medium-term assumption.

Supply-side pessimists might prefer an alternative approach that assumed a zero productivity shortfall: the output shortfall would be aligned with the mechanically estimated shortfall in jobs alone. Suitably adjusted for a possible increase in structural unemployment, the GDP shortfall on this basis would be about 4% in 1Q 2012.

⁴⁴ Gap adjusted, the annual pre-crisis rate of growth is reduced by ½ percentage point.

This wide range, between 4% and 9½%, still lies above the consensus view of the output shortfall, of which the OBR's forecast of 2½% may be representative.⁴⁵ The difference in estimates would materially affect judgments about the economy's ability to respond to demand and about the size of the cyclical component of the budget deficit. That cyclical component could be put as high as 6% of GDP in financial year 2011, 4 percentage points above the OBR's figure.⁴⁶

Central to the plausibility of these rival estimates is the interpretation of the economy's poor productivity performance: is the narrative more convincingly told from the demand side or from the supply side? We begin with demand.

⁴⁵ The OBR's minus 2.5% output gap figures for 1Q 2012 and 4Q 2011 are, respectively, a forecast and an estimated outturn. The latest available average of independent forecasts for the output gap in 2012 as a whole was minus 2.8%. (Source: HM Treasury "Forecasts for the UK economy", May 2012).

⁴⁶ Alternative estimate based on 2010 and 2011 financial year output shortfall estimates consistent with variant 4 in Table 8 combined with the OBR's rule-of-thumb cycle-adjustment coefficients. Rules-of-thumb suggested by international agencies would imply somewhat smaller differences in the cyclical element. The rules-of-thumb are detailed in OBR (2012), paragraphs 5.33 to 5.37.

Productivity shortfall – demand-side explanations

The demand-side explanation of the economy's productivity shortfall is simply stated. It is argued that major shocks abroad and at home depressed demand, as exports fell short and private saving rose, and increased people's willingness to accept low real wages as a means to preserve jobs. Output fell short but jobs much less so, implying widespread under-utilisation of labour. On this view, low productivity is a symptom not of structural distress but of a demand-constrained, cheaper labour economy.

Challenges to this view come in two forms: some doubt that demand shocks could be so deep and sustained: are not long-lasting shocks always supply shocks? A stronger challenge comes from supply pessimists who believe that the economy's ability to create jobs since 2009 is, ipso facto, grounds for dismissing an explanation of low productivity couched in terms of labour under-utilisation. We start with a sketch of aggregate demand and real wage developments before turning to this key criticism.

Demand shocks

After 2007, demand collapsed as banks and non-banks sought to repair the damage inflicted by the global property and financial derivative bubble and bust. By the first half of 2009, world trade,⁴⁷ UK exports and domestic expenditure by the private sector (consumption, fixed investment and stock building together) had all fallen by 10% or more.

Behind the collapse in domestic spending lay a resurgence of saving. A useful summary measure is provided by the private sector's financial surplus - the excess of private disposable (after-tax) income over spending. During the contraction, private disposable incomes fell much less than spending: private incomes were supported by government welfare spending and reduced tax take, much of this support occurring automatically as activity fell. The associated increase in the budget deficit meant that private disposable incomes were protected from the full impact of the downturn.

As a result, the private sector's financial surplus jumped spectacularly: in 2009, to nearly 10% of GDP, nine times the post-war norm.⁴⁸ Households, previously in aberrant financial deficit, accounted for most of the swing, as Chart 4 shows.

What motivated the rise in private saving? Part of the answer comes from the losses of stock market and housing wealth. There was also a deep shock to confidence and the need for greater precautionary saving. Businesses cut investment because capacity was under-utilised and prospects grim. Companies wanted to conserve cash flow, which swung more sharply than conveyed by their financial surplus.⁴⁹ But GDP fell by far more than could be explained by the loss of exports or by wealth and confidence effects hitting spending at home. It was, in the words of one of the present authors, the "recession puzzle of 2009".⁵⁰ Other factors were at play.

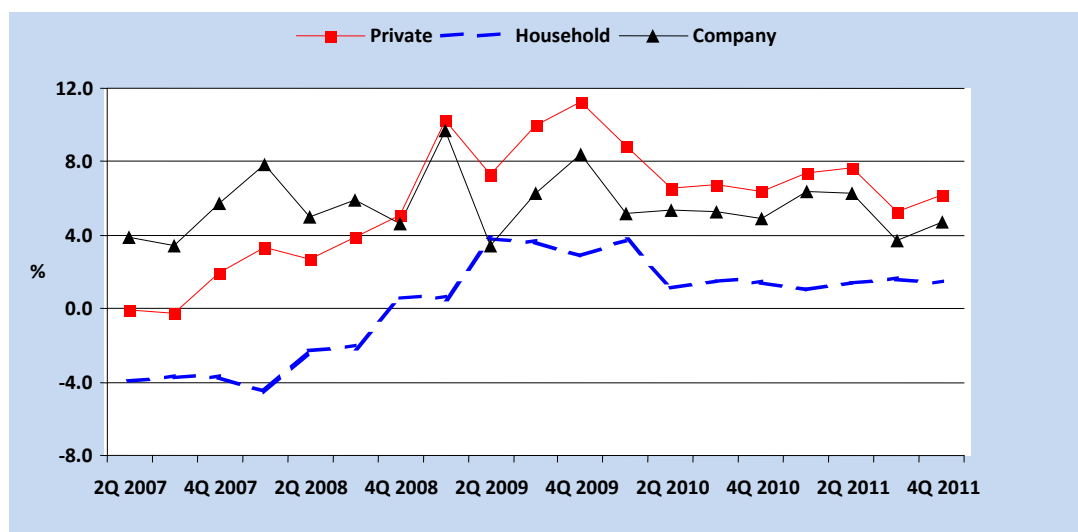
⁴⁷ Volume of world imports of goods and services (Source: OECD Main Economic Indicators).

⁴⁸ Evidence of reversion to a post-war norm of about 1% of GDP is given in Martin (2011b).

⁴⁹ Companies' financial surplus includes the profits retained by multinational companies' overseas operations, but not their investment spending. As a per cent of GDP, the companies' financial surplus excluding these retentions rose by nearly 5 percentage points between 2007 and 2009. This compares with a swing in the household sector financial surplus of over 6½ percentage points.

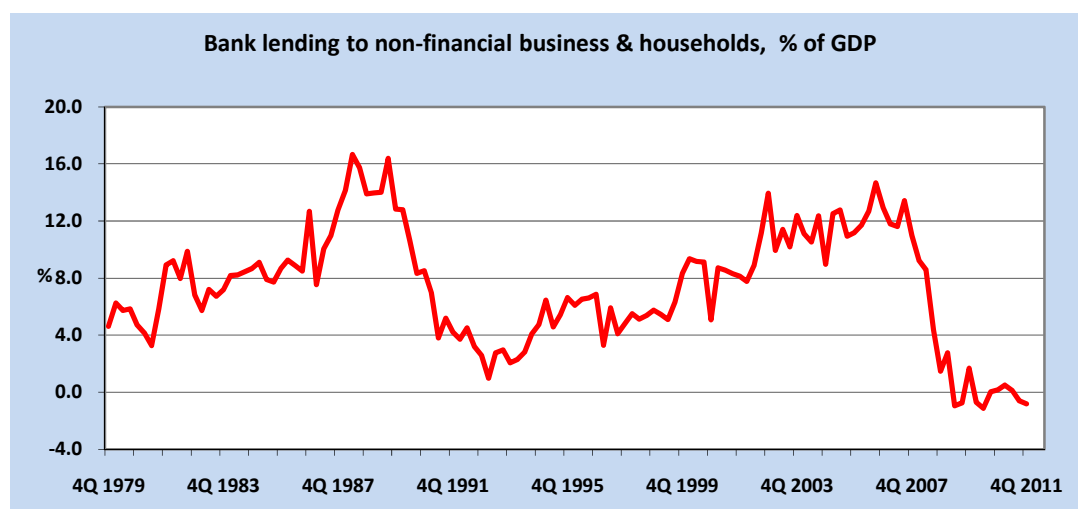
⁵⁰ Martin (2010a).

Chart 4: Private sector financial surplus, % of GDP



Sources and notes: ONS, authors' calculations. Private sector financial surplus (also confusingly called "net lending" in the national accounts) is defined as the sum of the financial surpluses of households (including non-profit institutions serving households), financial corporations (which, in the national accounts, include state-rescued commercial banks), private non-financial corporations, and public corporations (the latter included to avoid boundary data distortions) Also included is the national accounts residual error, the excess of the expenditure measure over the income measure of GDP, divided equally between the household and company sectors as an approximate method to allow for understatement of private income.

Chart 5: Bank lending, % of GDP



Sources and notes: Bank of England, ONS, authors' calculations. Monetary financial institutions' "net lending" (gross lending net of repayments) excluding securitisations.

Credit rationing was, and remains, a key factor.⁵¹ The flow of bank lending, net of repayments, to the non-financial private sector fell from 12% of GDP in 2007 to under 1% in 2009, as Chart 5 shows. Lending was negative in 2010 and 2011, modest lending to households being more than offset by a fall in lending to non-financial companies. The withdrawal of credit by overseas and domestic banks obliged borrowers to seek more equity and non-bank debt finance, but for most households and small and medium-sized enterprises the only option was to postpone expenditure, saving longer or more.⁵² Higher saving was “forced” as well as “desired”.

Also important was the related collapse in housing transactions and with it the reversal of the previous process of “equity withdrawal” – the excess of mortgage lending over investment in housing. The cash thus released from property had supported pre-crisis consumption, especially by the over fifties.⁵³ The hit to consumer spending was amplified too by the more marked retrenchment of the majority of consumers whose income disappointed, as against the minority who were pleasantly surprised. Amongst the disappointed were the young, severely hit by the recession.⁵⁴

The contraction was followed by a brief recovery in late-2009 and 2010. Several forces were at play: a sharp rebound of world trade, the impact of the relaxation of fiscal and monetary policy begun belatedly in late-2008, the uplift to international competitiveness arising from the large fall in sterling that had coincided with the contraction, and improved confidence. Amplified by a swing in the stock building cycle, private spending rose by 5½% in the year to the third quarter of 2010.

The economy then stalled in the face of headwinds: world trade decelerated, fiscal policy tightened,⁵⁵ import prices rose rapidly, depressing real incomes,⁵⁶ and business confidence fell after the summer, in reaction to the deepening crisis affecting banks and government debt markets in the Euro area.

⁵¹ Martin (2010a) summarises the then available evidence regarding credit demand and supply. Bell and Young (2010) subsequently concluded that “tight credit supply is likely to have been the dominant influence” behind the weakness of bank lending. Broadbent (2012) emphasises the impact of UK banks’ overseas losses without which “It is hard to imagine that the subsequent tightening in domestic credit supply, or the weakness of UK growth, would have been as severe”.

⁵² Miles (2011a) illustrates the dramatic impact on the duration of saving undertaken by first-time house buyers in response to changes in the deposit required by mortgage lenders.

⁵³ Reinold (2011) explains the key role played by homeowners who traded down or sold without buying another property: these cash injections into the household sector fell abruptly after 2007. Weale (2012) estimates that consumer spending by the over-fifties between 2003 and 2007 grew much more quickly than that of younger people, a difference not explained by real wage growth differentials.

⁵⁴ From the latest Bank-commissioned survey of household finances, Kamath and Reinold (2011) estimate that households’ propensity to cut spending when income disappointed exceeded by a factor of five the propensity to increase spending when income surprised. In the survey, 70% of respondents had experienced income shocks, which had a larger impact on the spending of the credit constrained. Weale (2012) finds that consumption by young adults after 2007 was weaker than that of older adults.

⁵⁵ As a share of GDP, the cyclically-adjusted budget deficit fell by 2 percentage points between financial years 2009 and 2010 according to the OBR. (Estimates of the structural deficit are probably less reliable expressed as changes rather than levels.) In September 2011, nearly 50% of households reported that they had been adversely affected by budget cuts (Kamath and Reinold (2011), Table B).

⁵⁶ National income was depressed by ½% by the deterioration in the international terms of trade over the year to 3Q 2011 but by only ¼% in the year as whole.

The result today is an economy with spending still deeply depressed relative to the previous trajectory. Global conditions are partly to blame: world trade has recovered, but at nothing like its pre-crisis growth rate.⁵⁷ UK exports are likewise depressed, and account directly for over 2½ percentage points of the GDP shortfall in the final quarter of 2011, though rather less with allowance for the associated reduction in imports. Most of the remaining GDP shortfall is attributable to the shortfall in private spending, more marked for fixed investment than for household consumption, but with the latter, because of its higher share in spending, having the greater impact.

Behind this weakness lies the aberrantly high private sector financial surplus, as a share of GDP in 2011 still six times the post-war norm and six percentage points above the near-norm level in 2007. The swing comes from households' shift to thrift but the persistence of the overall surplus also reflects companies' continued caution.

For the productivity debate, the importance of the demand-side narrative is straightforward. According to this interpretation, output has fallen short not because of a seizure of productivity advance but because of a large, persistent demand shortfall, with the normal self-stabilising properties of the economy overwhelmed.

The persistence of these shocks and the way they have propagated stagnation should not come as a surprise, even though such circumstances are barely recognised in modern macroeconomic models. Major recessions have precisely this quality of persistence, as the late Christopher Dow documented in his magisterial historical account.⁵⁸ Almost forgotten too are the theoretical insights of Axel Leijonhufvud, who imagined modern economies travelling within a "corridor" of stability, stable within the corridor but, if displaced, having no tendency to return.⁵⁹

The corridor of stability depends, in part, on the effectiveness of monetary and fiscal policy to counteract the business cycle, yet both are constrained. Monetary policy is constrained because bank rate is close to zero, leaving the central bank with bond purchases as its prime but not obviously powerful weapon.⁶⁰ Fiscal policy is constrained because escalating government debt has incited fears of sovereign default and called into question the government's ability fully to safeguard a still-vulnerable banking system. Far from counteracting the business cycle, fiscal policy in the UK and in its major trading partners is acting to restrain demand, not support it. Worse still, the attempt by both the private sector and governments simultaneously to strengthen financial balance sheets, at a global level each a counterpart of the other, invites the possibility of a destabilising downward spiral: the "battle of savers".⁶¹

⁵⁷ Based on mechanical extrapolation of the pre-crisis trend, the shortfall in world trade may have been close to 20% by the close of 2011.

⁵⁸ Dow (1998).

⁵⁹ Leijonhufvud (1973).

⁶⁰ Meaning and Zhu (2011) report evidence of diminishing returns to quantitative easing.

⁶¹ Martin (2010b).

In such circumstances, consumers may well act rationally to curtail spending in line with their expected low future disposable income, as stressed by MPC member Martin Weale.⁶² But in the process, consumers would further depress demand, undermining confidence and business investment. Low demand becomes self-fulfilling.⁶³

Real wage adjustment

Although far more severe than previous major recessions, the shocks to demand after 2007 exacted a surprisingly small toll in terms of unemployment. In the early-1980s recession and its aftermath, the unemployment rate rose by 6½ percentage points; in the 1990s episode, unemployment rose by 3¾ percentage points. In each case, labour market participation fell sharply and unemployment continued to increase well after the trough in activity. But over the last four years, the participation rate has fallen modestly while the rate of unemployment has risen by “only” 3 percentage points, from 5¼% to 8¼%. It has hovered around 8% for the better part of two years.

It is not novel to suggest that wage moderation in relation to prices played a key role in securing this relatively benign employment outcome, helping to preserve businesses’ cash flow, profitability and jobs.⁶⁴ Real wage moderation is a key feature that distinguishes the current episode from the previous major recessions.

Table 9 draws that comparison. It shows that in the first quarter of this year, real consumption wages – nominal wages in relation to consumer prices – were nationally over 8% below the level at the business cycle peak. By contrast, in previous major recessions, real wages at a similar stage in the recovery were on average 5½% above their previous peak. In those episodes, national productivity was at that stage higher, not lower, than peak, but the loss of employment after adjusting for population was on average greater than today, notwithstanding the stronger recovery in GDP per head.

Companies’ financial position offers a vital clue to these different outcomes. Despite the depth of the post-2007 contraction, non-bank companies’ cash flow remained well above the low levels plumbed in previous major recessions, as Chart 6 illustrates. Low interest rates as well as wage moderation helped: measured from the peak, nominal short-term interest rates averaged 10% or more in the earlier episodes.

⁶² Weale (2012). It is of note that UK households expect budget cuts to have a bigger impact in the future than in the past (Kamath and Reinold (2011)).

⁶³ Temin (1976) emphasises loss of confidence as a force sustaining the 1930s Great Depression. Harrison and Weder (2006) develop a formal model in which despondency is self-fulfilling.

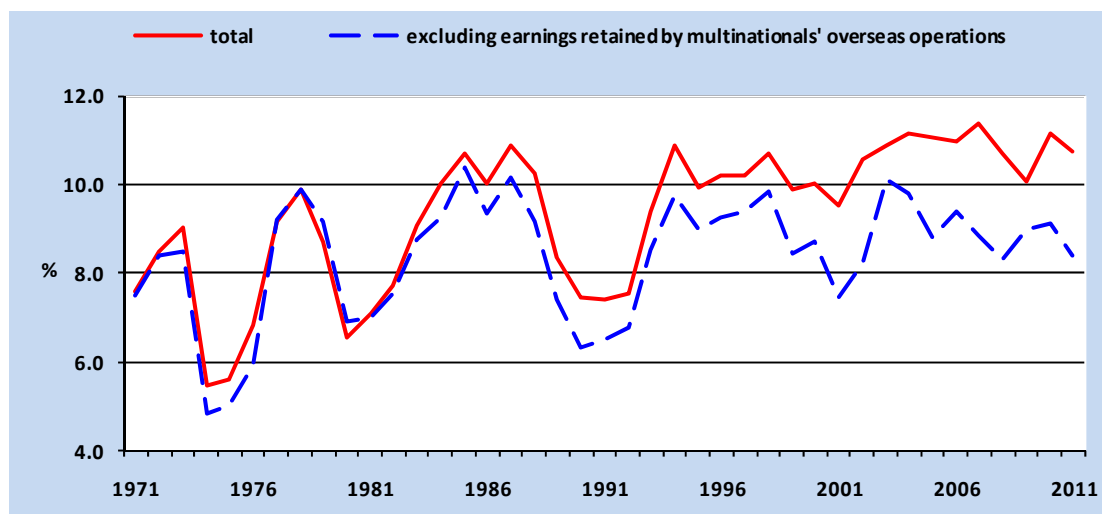
⁶⁴ For similar diagnoses, see, for example, Gregg and Wadsworth (2010) and Faccini and Hackworth (2010).

Table 9: Real wages, productivity & employment in major recession episodes

Relative to pre-contraction peak* % or % point difference	Real wage, %	Output per worker, %	Employment rate, % points
2008 and after	-8.5	-3.4	-2.3
Post-war before 2008			
simple average	5.5	8.2	-3.3
of which:			
early-1990s	3.7	10.6	-3.6
early-1980s	9.2	9.3	-4.4
mid-1970s	3.6*	4.9	-1.8

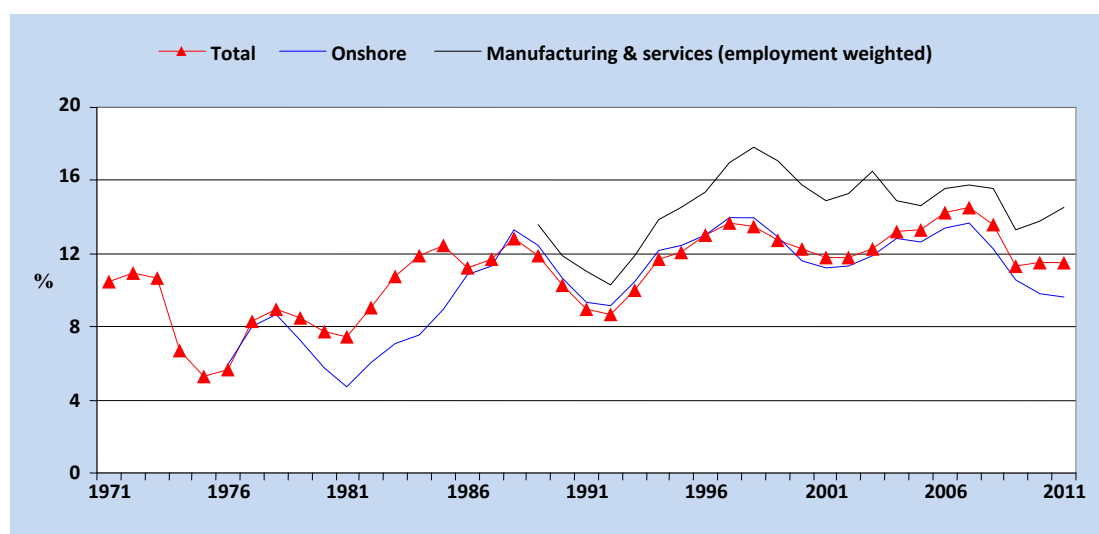
Source: ONS, authors' calculations. Cycle peaks and troughs are described in the notes to Table 2. * 11 quarters after trough. Output per worker – whole economy real gross value added per worker (see Table 5). Employment rate – number of employed workers as a per cent of adult population. Real consumption wage - whole economy nominal average weekly earnings (including bonuses) relative to consumer price index. Before 2000, average earnings are measured using the former average earnings indices published in *Economic Trends Annual Supplement*, various editions. Consumer price index data before 1988 are taken from Donoghue (1998) back to 1975. * Real wage figures for the mid-1970s recession are of suspect quality. Before 1975, prices are measured using the retail price index. The coverage of the ("older series") average earnings index is confined to production industries, agriculture, transport and a few miscellaneous services (such as laundries and motor repairers).

Chart 6: Private non-financial companies' retained profits, % of GDP



Source: ONS, authors' calculations. Retained profits equal gross operating surplus plus property income (which includes the retained earnings of multinational companies' overseas operations) minus the sum of net interest payments, taxes and dividends. Figures prior to 1987 should be regarded as broad-brush. They are derived from unrevised historic data consistent with standards that existed prior to the conversion to the latest European System of Accounts (see Martin (2009)).

Chart 7: Private non-financial corporate rate of return on domestic capital, %



Source: ONS, authors' calculations. Private non-financial corporations' pre-tax operating surplus net of depreciation from UK trading activities as a per cent of net capital employed. Figures prior to 1997 are taken from pre-2011 Blue Book data and linked after allowing for discontinuity. The onshore total excludes companies involved in North Sea oil and gas extraction. The employment weighted series combine net rate of return figures using as weights the shares in the total of payroll-based estimates of jobs found in manufacturing and in total services excluding the financial intermediation, public administration, health and education sectors.

The same surprising resilience is seen in businesses' return on domestic capital. Chart 7 shows that the profitability of non-financial corporations has remained above the low levels seen in previous major recessions. High energy prices have helped raise returns from North Sea oil and gas operations, despite lower production, but equally have depressed the profits of energy users: manufacturers' profitability fell sharply in 2011. More relevant for employment has been the high profitability of non-financial service companies. The chart records a measure of return with sectors' returns weighted according to shares in employment rather than shares in domestic capital. This series for manufacturing and non-financial services together rose in 2011 to a level only a little below the average achieved in the pre-crisis post-millennium years.

In general, it appears that job losses were contained because businesses started from a strong financial position, and compared with previous major downturns were under less pressure to rationalise, thanks to low interest rates as well as wage moderation. Fewer firms went under as a result, and survivors were able to retain key staff. The next section gives further consideration to the precise mechanisms involved.

The remaining question for this section concerns the reasons for the unusual fall in real wages: why are workers willing to work for so much less? The answer is not clear-cut, although several explanations can be ruled out.

One of these portrays the fall in real wages as a temporary feature, the result of workers' failure fully to anticipate the rise in price inflation. If true, real wages would recover as workers adjusted their inflation expectations and pressed for higher pay to make good lost ground. But the deceleration since 2007 in nominal wages, as prices accelerated, and the

persistence of the shortfall in real wages make this an unlikely explanation.⁶⁵ In general, households appear to have little desire to demand higher pay for fear of putting jobs at risk.

Responses to special questions in the Bank of England's regular omnibus survey make this clear. In the February survey, only 8% of households said they would seek increased wages in the light of their near-term expectations of inflation.⁶⁶ The majority of respondents said they would "hunker down" in one way or another. Nearly a quarter said they would look for a different or second job, or work longer hours. The responses were similar in the February 2011 survey.

A second explanation is that real wages had to fall in response to the deterioration in Britain's international terms of trade. An increase in the price of imports in relation to the price of exports depresses national income and requires a fall in real wages in order that the burden is efficiently shared between businesses and workers.⁶⁷

However, the requisite fall in real wages is too small to account for more than a minor fraction of the observed shortfall in real wages. In the final quarter of last year, the deterioration in the UK's international terms of trade amounted to only 2%, whether measured against the level at the business cycle peak or against the pre-crisis trend. The implied requisite fall in real wages was ¾%. Yet the shortfall in real consumption wages reckoned against the pre-crisis trend was in excess of 15%.

The details in Table 10 also dispatch the thought that the fall in real wages may be industry specific. It is true that the shortfall in finance is greater than average, partly thanks to the high pre-crisis trajectory, but there are large real wage shortfalls across the economy. In each sector, pre-crisis growth has given way to contraction. In manufacturing where data are readily available, the conclusion also stands if real wages are redefined in terms of product prices rather than consumer prices. In the first quarter, the shortfall in manufacturing real product wages was over 17%.

The most convincing explanations of low real wages draw a connection between households' reactions to the crisis both as workers and as consumers. The same shocks that produced the shift to thrift may also explain why real wages have fallen so dramatically. Over-indebtedness, credit rationing and the need to make good inadequate pensions may well have encouraged workers to seek (but not necessarily secure) longer hours of work and to accept low pay in return for new or continuing employment, thus reducing the risk of personal bankruptcy and penury.⁶⁸

Such considerations help to explain the relatively small fall in labour market participation since 2007, a sharp contrast to the early-1990s recession when comparatively generous early retirement packages and state disability benefits made withdrawal from work a less

⁶⁵ The deceleration in nominal pay accounts for two-thirds of the national real wage gap in 1Q 2012.

⁶⁶ Bank of England/Gfk NOP Inflation Attitudes Survey.

⁶⁷ The neoclassical theory relevant to this point is explained in Martin and O'Connor (1981). Miles (2011b) notes, "If the things we import are more expensive our standard of living has to fall."

⁶⁸ Bank of England economists Benito and Saleheen (2011) find that in response to financial disappointments employees seek longer hours of work, especially by changing jobs. Kamath and Reinold (2011) report a similar response in the latest Bank commissioned survey of household finances. Related theory and evidence are offered by Bottazzi (2004), Bottazzi et al. (2007), Campbell and Hercowitz (2006), and Del Boca and Lusardi (2003).

financially painful course of action.⁶⁹ Also consistent with this explanation is the increased willingness of people to work part-time to make ends meet: in the last four years, the proportion of those working part-time because they could not find full-time employment has risen from about 10% to 18%.

Table 10: Real wage growth and gap

Annual average growth, %, unless stated	Before cycle peak	Since peak to 1Q 2012	Gap (%) 1Q 2012
Whole economy consumption wage	2.3	-2.2	-16.6
Of which:			
Public sector (ex. nationalised banks)	2.3	-1.4	-13.7
Private sector	2.4	-2.5	-17.8
Manufacturing	1.9	-1.2	-11.7
Construction	2.3	-2.5	-17.5
Distribution, hotels & restaurants	1.8	-1.5	-12.4
Transport	2.2	-1.4	-13.3
Information & communications	2.0	-1.2	-12.1
Finance, professional & support services	3.0	-3.0	-21.5
Memo:			
Manufacturing product wage	2.8	-2.1	-17.6

Sources and notes: ONS, authors' calculations. "Before cycle peak": seven years ending 1Q 2008; "Since peak to 1Q 2012": period from 1Q 2008. "Gap" – difference between level and extrapolated pre-cycle peak trend, as per cent of trend. Real consumption wage: nominal average weekly earnings (including bonuses) relative to consumer price index. Official not seasonally adjusted data used, and seasonally adjusted, in case of Transport and Information & Communications. Manufacturing product wage: manufacturing nominal earnings relative to output prices (a weighted average of prices of manufactures sold at home and exported).

⁶⁹ Blundell and Johnson (1997) detail the impact on participation rates of early retirement packages and the availability of invalidity and sickness benefits in the early-1990s recession.

Labour hoarding and the jobs recovery

In summary, the demand-side explanation sees low productivity as a symptom of depressed demand and depressed real wages. Output is well below potential because workers, while cheaper to employ, are not working to potential. More output could be produced, but not sold. There is an effective demand failure, high unemployment and, within companies, under-utilisation of labour – a form of “labour hoarding”.

The strongest challenge to this explanation comes from those who point to the expansion of private sector jobs that has occurred since 2009 and ask the pertinent question: why would firms employ more people if their existing labour force were in excess of requirements? In answering, many reject the idea that low productivity reflects under-utilisation of labour, and give more weight to structural explanations.

Bank of England officials have led this charge. Last September, Spencer Dale said, “It is difficult to understand why firms should increase employment so significantly if their existing workforce is not fully utilised”. In November, MPC member Martin Weale added: “... we know that, in the early part of this year some service industries were taking on new labour even though their productivity levels were well below trend; this is not consistent with labour hoarding.”⁷⁰ The Bank’s Inflation Report also questioned the presence of “widespread labour hoarding” in view of “... relatively strong private sector employment growth over 2010 and the first half of 2011 ...”.⁷¹

In this section, we seek to refute this challenge, first in terms of high-level principle, setting in context the arguments to be found in the mathematic appendix. A key distinction is drawn between *overhead* labour and *variable* labour, a distinction that immediately reconciles the co-existence of under-utilised workers and job creation to which Dale and Weale refer. Also explained is the relevance of hoarded variable labour, and how firms’ decision to hoard is affected by the costs of firing and hiring, the expected duration of recession and wage moderation. It is concluded that the supply-pessimists’ challenge would have validity had firms banked on a full recovery and hoarded their entire labour force, but this is a most unlikely state of affairs. We show that the creation of private jobs since 2009 has arisen within that part of the private economy that had less incentive to hoard but more to gain from cheap labour.

To set these points in context, we begin with a sketch of the path taken by private sector jobs since the business cycle peak. Several phases can be seen in Chart 8. An initial decline in jobs is followed by a plunge as the crisis hits home. Helped by a revival of self-employment, job levels broadly stabilise in the second half of 2009. A recovery follows: an impressive 660 thousand jobs are added between December 2009 and June 2011, an annual growth rate of 1¾%.⁷² Jobs of employees and the self-employed expand at similar rates, in the case of employees, three times the pre-crisis norm. But the expansion abates after the summer of 2011. Employee jobs fall between June and September and the offsetting rise in self-employment is widely interpreted as a sign of labour market weakness.⁷³ Employee jobs

⁷⁰ Weale (2011b).

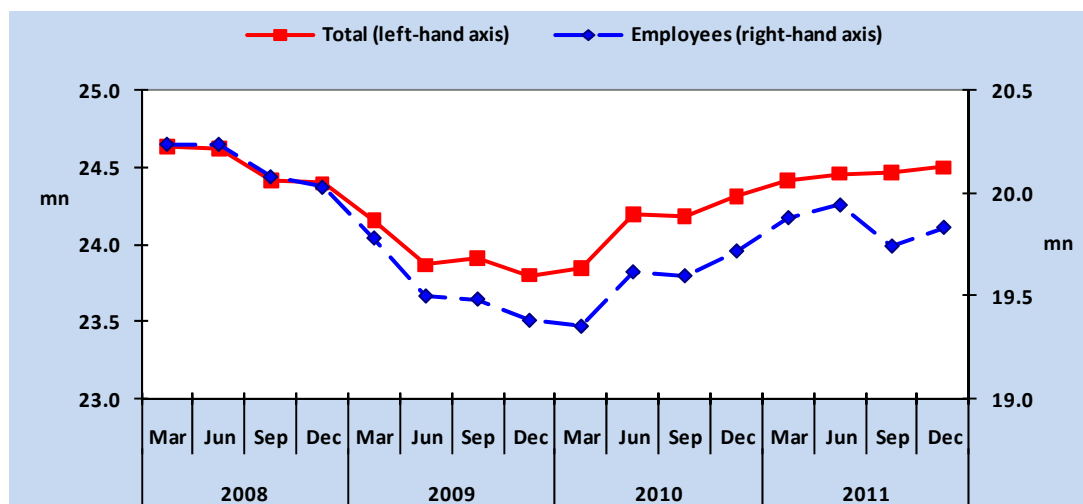
⁷¹ Bank of England (2011c), 45-46. See, also, Tucker (2011).

⁷² The overall increase is calculated net of the reduction in jobs in state-supported banks.

⁷³ Myers (2011), for example, suggests the offsetting rise in self-employment may result from “... people setting up their own businesses in the absence of being able to find work as an employee.” In the Labour Force Survey, people classify themselves as self-employed.

revive modestly in the final months of 2011, but self-employment falls, leaving the number of private sector jobs little changed on summer levels, and employee jobs lower.

Chart 8: Private sector jobs



Sources and notes: ONS, authors' calculations. Private sector jobs are derived by deducting official estimates for public sector employment (PSE), available at end-quarter intervals, from the Labour Force Survey of UK jobs (total and employees), including those with second jobs, taken at the relevant mid-month of the LFS continuous three-month estimates. The PSE data provide a quarterly measure of the number of employees in the public sector, primarily in administration, education and health. In addition to those employed by public sector organisations, the PSE data include workers whose main job is in the private sector but with a second job in the public sector and workers with two public sector jobs. The self-employed (around 20 thousand in public administration) are excluded. The total level of private sector jobs, derived by residual, is somewhat understated. To avoid a statistical discontinuity, employees of state-supported banks are included in the private sector totals.

Overhead labour, variable labour and the costs of firing and hiring

Private sector employment appears, then, to have increased substantially since the end of 2009. Despite the setback in the second half of 2011, there were by last December an extra 700 thousand private sector jobs, 450 thousand of which were employees. Can this jobs expansion be squared with the notion of a productivity shortfall? As the comments cited earlier make clear, it has been argued the two cannot co-exist.

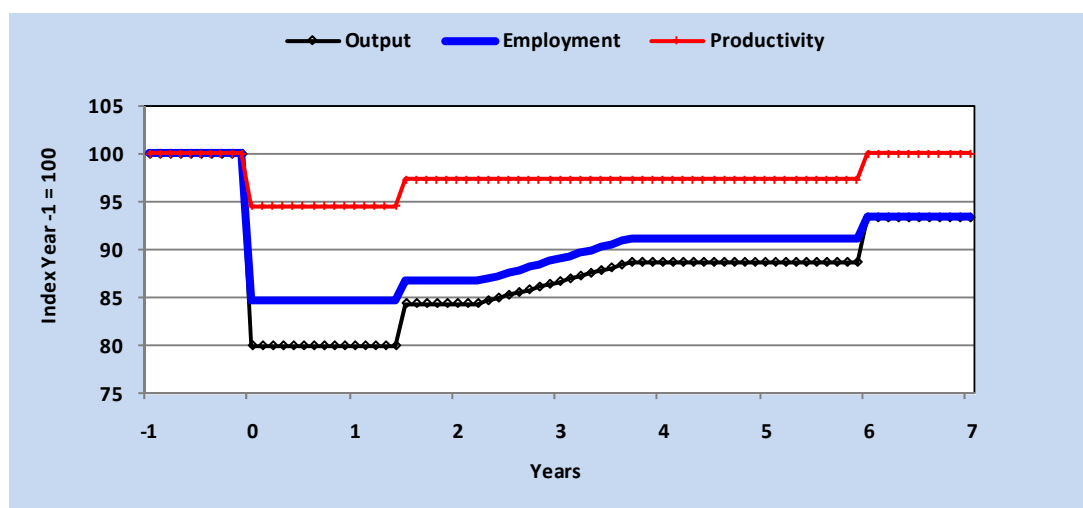
But that argument is easily refuted. It fails to recognise a basic and long-standing distinction between variable labour, hired and fired as output goes up and down, and overhead labour, required in order to keep a business going.⁷⁴ Examples of variable labour may include assembly line workers and telesales staff. Examples of overhead labour may include senior management, key administrators and staff required to maintain brand image or safety standards. Overhead labour is a minimum quantity of labour that remains employed until a firm goes out of business.

To appreciate the importance of this distinction, consider the case of firms that survive recession by scaling back their variable labour fully in line with the lower level of sales but

⁷⁴ Kuh (1965) draws the distinction between overhead and variable labour in an early study of pro-cyclical productivity. Bernanke and Parkinson (1991) also note "An alternative to costly adjustment as a motivation for labour hoarding is that there is some fixed quantity of "overhead labour" ...".

retain overhead labour. Despite the labour shakeout, such firms would experience a shortfall in output per person: overhead labour would be under-utilised, being spread over a lower level of sales. Come recovery, the same firms would recruit variable labour in line with the higher level of sales, and enjoy a restoration of normal levels of productivity, as the utilisation of overhead labour improved. In these circumstances, the co-existence of a productivity shortfall and the expansion of employment during the recovery poses no puzzle at all.

Chart 9: Simulation of recession in a model with premature scrapping



Sources and notes: Mathematical appendix: Model of plant births and deaths.

Chart 9 illustrates the pattern in an imaginary economy that suffers a severe recession in year zero followed by a stepped recovery. Employment initially falls steeply, although not as steeply as output. Overhead labour is retained and productivity falls. With recovery, employment expands, as more variable labour is taken on in line with the increase in output. Productivity also recovers because overhead labour is better utilised. Eventually productivity returns to its pre-recession level but, in the case considered in this model, employment and output do not: it is assumed that the recession leads to some premature scrapping of capacity that is not replaced.

In this example, the under-utilisation of labour during recession arises solely because of the retention of overhead labour. But under-utilisation would also arise should some firms choose to hoard variable labour. Firms may do so to avoid both the costs of firing labour and the expected costs of rehiring labour once recovery comes.

Firing costs include redundancy payments and other costs that may arise from employment protection legislation. Writing in the Bank of England’s Quarterly Bulletin in 2010, Renato Faccini and Christopher Hackworth report a figure of £12,000 for the average redundancy payment. They note that other costs associated with employment protection have probably changed little since the early-1980s.⁷⁵

⁷⁵ Faccini and Hackworth (2010).

Hiring costs include time and effort spent on searching for, and screening, potential recruits and the costs incurred in the form of lost production while new hires learn the ropes. The more skilled the job, the greater the likely hiring cost. Faccini and Hackworth argue that the rising fraction of working-age employees with a university degree or higher education and firms' fear of skill shortages may have raised perceived hiring costs, so increasing the incentive to hoard labour.

Firms' decision to hoard variable labour during a downturn depends on a balance of considerations. Hoarding avoids firing and hiring costs but incurs the cost of retaining labour that for a period will be surplus to requirements. Changes in the expected duration and depth of the downturn will affect this calculation, as will wage rates.⁷⁶

Firms that face firing and hiring costs that are high in relation to wages and confidently expect a recession to be short-lived may decide to retain all their labour: a case of full labour hoarding. But others for whom the calculation is more finely balanced will retain only that part of the variable labour force that could be profitably employed in conditions of less than full recovery: partial labour hoarding.

The distinction between full and partial hoarding has an important bearing on the productivity debate. Had businesses hoarded all their labour, there would naturally have been no need for net new hires in the upturn. Such an outcome would fit the argument of productivity pessimists who take the post-trough increase in jobs as evidence that labour has *not* been hoarded. But in the circumstances of 2008 and 2009 it is most unlikely that firms banked on a full recovery. Labour hoarding is more likely to have been partial, and limited to firms facing high firing and hiring costs.

Changing expectations of recession and recovery

This aspect of the story of the fall and rise of private sector jobs can be told granted a suitable measure of businesses' expectations. As a rough guide, Charts 10 and 11 trace an indicator of short-term business confidence and the evolution of economists' forecasts of UK GDP growth up to two years ahead. Several phases can be distinguished. During the contraction, it is more than likely that firms radically revised down their expectations of recovery, while by late 2010 some may have become over-confident. These changes affected the course of employment.

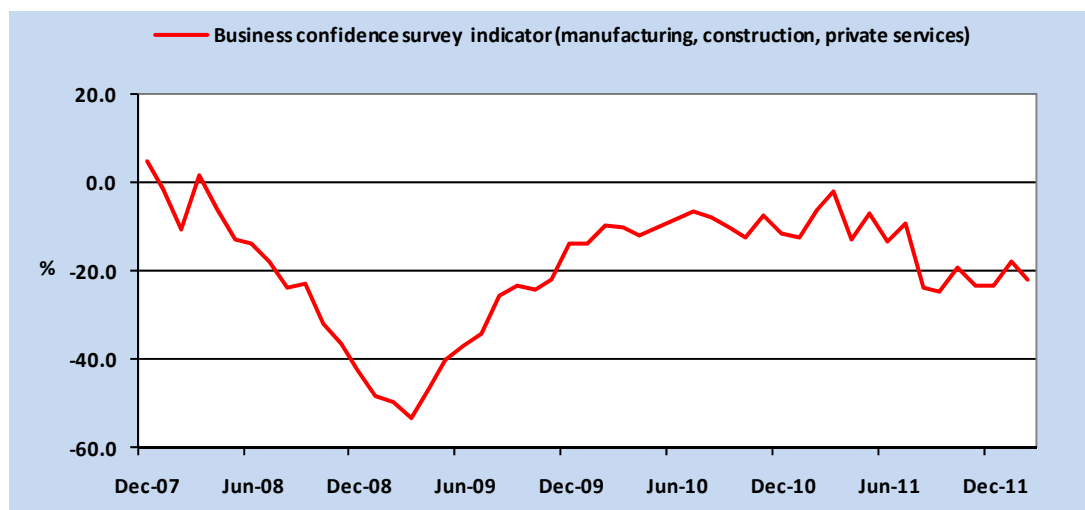
During the contraction, firms were confronted by the events in mid-September 2008 that brought the global banking system close to collapse. Stock market valuations and consensus expectations for growth at home and overseas duly fell, and worse case scenarios were given weight in the face of deep uncertainty. Business confidence declined until spring 2009, coincident with the cycle trough and with further significant downgrades to consensus expectations of growth in 2009 and 2010.⁷⁷

⁷⁶ At its simplest, ignoring discounting, a firm would not hoard one worker costing f to fire and h to hire and paid a wage of w a year were the expected number of years R in recession to imply: $Rw > f+h$.

⁷⁷ Even in the midst of the global banking crisis in November 2008, the consensus envisaged no more than a 1% decline in GDP in 2009, followed by 1¼% growth in 2010. By March 2009, the expected contraction that year had been revised to 3% and the expansion expected in 2010 downgraded to ½%. Growth expectations for 2009 continued to fall throughout the year but those for 2010 gradually revived, reaching 1¼% again by October 2009.

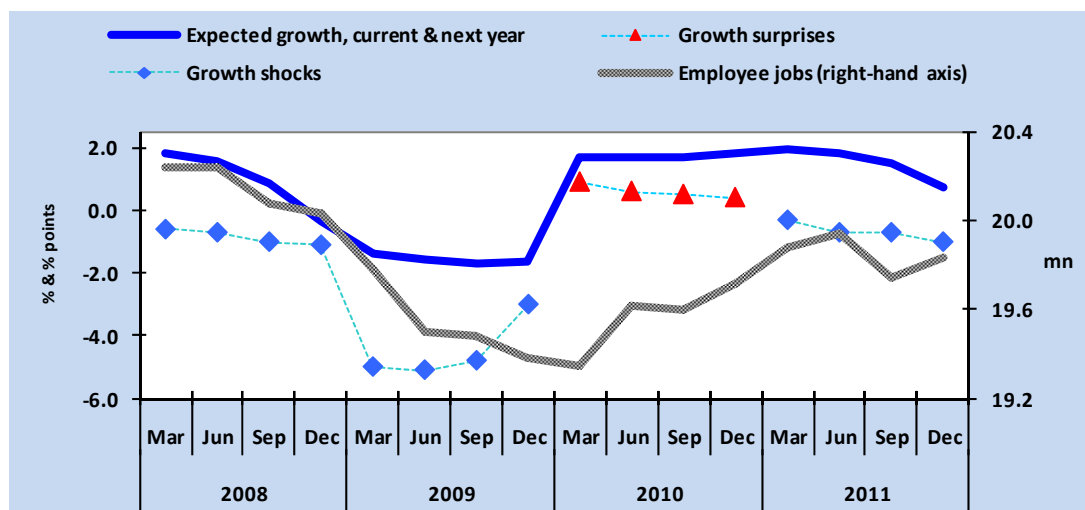
In the face of this shock, businesses probably drew up revised strategies predicated on a longer period of weak activity. Nearly 600 thousand private sector employee jobs were lost between September 2008 and June 2009. Firm closures would account for some part of this abrupt fall but it is plausible to suppose that another part reflected some firms' decisions to cut labour previously hoarded in expectation of better times.

Chart 10: Short-term business sentiment indicator



Sources and notes: OECD *Main Economic Indicators*, authors' calculations. The measure shown is a value added weighted average of composite confidence indicators for each sector. The indicators are the arithmetic average of respondents' replies to questions regarding the three-month conjuncture and outlook ("ups" minus "downs").

Chart 11: Consensus growth expectations and private sector employee jobs

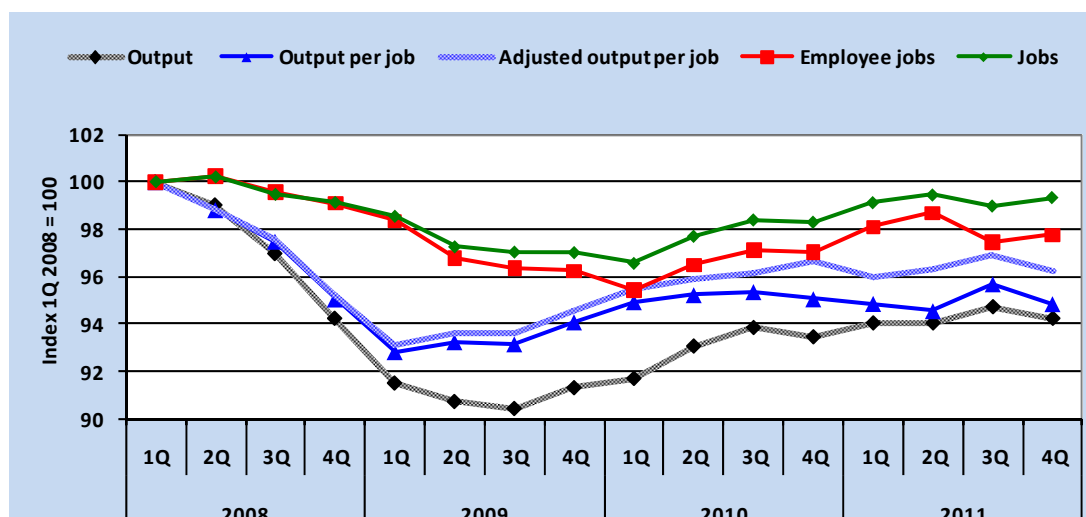


Sources and notes: ONS, HM Treasury "Forecasts for the UK Economy", authors' calculations. Expected growth, current & next year: compound average of consensus forecasts for GDP growth in current and subsequent year; dates refer to the month in which the forecast is published in the HM Treasury compilation. Growth shocks and surprises: difference between the GDP growth forecasts for current year "T" published at the dates shown and the forecast for year "T" published a year earlier. Negative values indicate over-prediction ("growth shocks"); positive values indicate under-prediction ("growth surprises"). For example, the growth shock value in March 2009 of -5.0% is the difference between the consensus forecasts for 2009 growth published in March 2009 (-3.1%) and March 2008 (1.9%). Shock and surprise values provide a guide to the swing in sentiment. Employee jobs: end-quarter LFS estimates of private sector employee jobs including those in state-supported banks.

During the upturn, two phases can be distinguished. The first lasting until early-2011 is marked by initially steeply rising confidence and gradually upgraded consensus expectations of growth. In January and February 2011, the consensus held that GDP would grow that year and again in 2012 by 2%, slightly above the perceived 2010 outturn, which had modestly exceeded expectations.⁷⁸ In the second phase after early-2011, optimism faded. Expectations for 2011 growth fell throughout the year; those for 2012 held up until the summer but dropped dramatically thereafter. The downgraded consensus and the slide in short-term business confidence coincided with an intensification of the crises affecting member countries of the euro area.

In the first recovery phase, private output, productivity and jobs revived sharply, as Chart 12 shows. By the third quarter of 2010, productivity may have risen over the year by 2½% or more, the figure depending on any allowance for statistical bias, and output by as much as 4%. Private jobs were up 1½%. Surviving firms that had fully shed variable labour rehired and enjoyed better productivity as the utilisation of overhead labour rose. Other expanding firms that had no need to hire experienced an improvement in the utilisation of both overhead and hoarded variable labour.

Chart 12: Market sector output, job and productivity indices



Sources and notes: ONS, authors' calculations. Market sector output – see notes to Table 3. Market sector jobs are quarterly averages of total Labour Force Survey jobs taken at the relevant mid-month of the continuous three-month LFS estimates minus a quarterly interpolation of the Public Sector Employment general government headcount (see notes to Chart 8). Productivity is output per job (employee and self-employed). The adjusted productivity series allows for possible upward revisions and erratic factors affecting output (see notes to Table 7).

The second phase of recovery after early-2011 poses a puzzle: output hardly grew on balance but jobs continued to expand rapidly until the summer of 2011. Growth disappointment provides part of the explanation. Firms that had to plan their recruitment on the basis of anticipated demand may well have been wrong-footed by expectations of

⁷⁸ The January and February 2011 consensus forecasts put the 2010 growth outturn at 1.7% and 1.5% respectively, below the current official estimate.

recovery that turned out to be too optimistic. Firms probably *over-hired*, an error that may have been partly corrected in the second half of 2011.

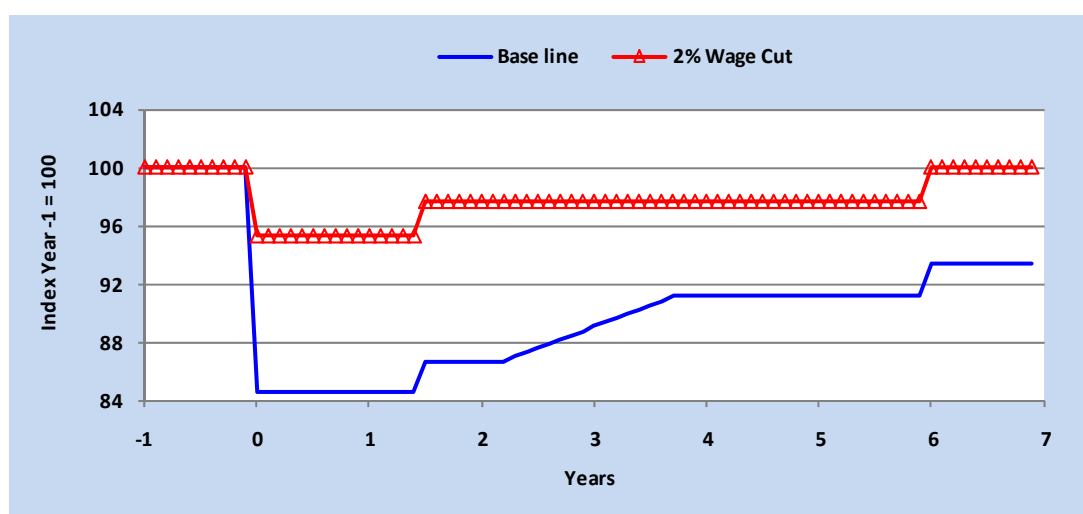
The impact of wage moderation

This narrative usefully highlights the jobs shake-out in the worst moments of the crisis, the recruitment of variable labour during recovery, and the likely temporary over-hiring in the first half of 2011. But it is wage moderation that must take centre stage if the main feature of the current cycle is to be explained. As Chart 12 recalls, private sector employment in the final quarter of last year had returned close to a level previously seen at the cycle peak, but output was still significantly lower. How precisely did wage moderation support the level of private sector employment?

In principle, three impacts can be distinguished: on the survival rate of firms; on the incentive to hoard variable labour notwithstanding the depth and duration of recession; and on the choice of production technique. Each is considered in turn.

As regards firm *survival rates*, such evidence as exists suggests that the rate of company incorporation net of dissolutions has remained since 2007 above levels seen in the early-1990s recession.⁷⁹ Wage moderation may well have supported firms' profitability, current and prospective, and thus raised firms' chances of survival.

Chart 13: Simulated employment in a model with premature scrapping



Sources and notes: Mathematical appendix: Model of plant births and deaths. The recession is assumed to begin in year zero. The wage cut refers to firms' forward expectation of the sustainable reduction in real wages over a six-year period, a figure that is assumed to be less than the observed real wage shortfall since 2007.

⁷⁹ Bank of England (2011c), Chart 3.10, p31. The figures on company dissolutions are distorted by an exercise to tidy the Companies House register in 2009. ONS data on firms' demography include births and deaths of businesses that are not registered for Value Added Tax in addition to those that are. The latest figures show business deaths exceeded births in 2009 and 2010, but comparable figures before 2001 are not available ("Business Demography 2010", December 2011). Previous VAT-only based data collated by the then Department for Business, Enterprise and Regulatory Reform were distorted by substantial increases in the VAT registration thresholds in 1991 and 1993. Consistent with the Bank's evidence, Bhaumik (2011) finds that the rate of insolvencies, adjusted for the impact of the 2002 Enterprise Act, has remained below that seen in the early-1990s.

A formal model, described in the appendix, can be used to illustrate the impact on firms' births and deaths, and the likelihood of firms' premature demise. Simulated with a reduction in the level of the real wage that firms regard as sustainable, the model produces a significantly higher level of employment, as Chart 13 shows. The size of the impact reflects an assumption that the greater the number of surviving firms, the higher would be the overall level of output. An alternative assumption would have surviving firms competing for market share, with a smaller effect on GDP. The qualitative conclusion remains that wage moderation may have been a significant force supporting economic capacity and employment.

A second influence of wage moderation comes through the impact on *labour hoarding*. Firms would be more likely to hoard if they thought wages were likely to fall sustainably in relation to the costs of firing and hiring.⁸⁰ Lower wages reduce the cost of labour that is, for a period, surplus to requirements. This effect needs to be set in context, however. Low wages came with recession, and the longer businesses expected recession to last, the less inclined they would have been to retain labour.

The opposing forces can be illustrated using a second model, formally described in the mathematical appendix. Table 11 records the simulated values, in the form of indices, of employment and productivity in an imaginary economy in which output falls steeply from a normal level, and then recovers in two steps. Firms decide whether to hoard labour or not, and, if the former, whether to retain labour required to meet the full-recovery level of output (full labour hoarding) or the level of output expected during the initial post-recession upturn (partial labour hoarding).

Table 11: Simulation of variable labour hoarding

Scenario Indices	---- No wage moderation ----			-- Sustained real wage cut --		
	Recession	Upturn	Normal	Recession	Upturn	Normal
Output	90.0	95.0	100	90.0	95.0	100
Employment	91.6	95.8	100	93.7	95.8	100
Productivity	98.3	99.2	100	96.1	99.2	100

Sources and notes: Mathematical appendix: Model of labour hoarding. Indices set to 100 in normal conditions. Base case simulation values are taken but with the length of recession and upturn phases each extended by 2 years. In the no wage moderation case, variable labour hoarding is zero. In the sustained real wage cut variant (cut of 5%), 50% of firms do not hoard variable labour; 50% of firms partially hoard variable labour. This latter variant produces results identical to the base case.

As simulated, it turns out that firms decide either not to hoard labour as recession hits or do so partially; none engages in full hoarding. In the absence of wage moderation, no labour is hoarded. The result, shown in the left-hand side of the table, is a steep fall in employment. In the alternative scenario, firms additionally factor in a sustained real wage reduction. Half

⁸⁰ Nickell (1978) draws this same inference from a formal theoretical model in which firing and hiring costs are identical across firms. The labour hoarding model in the mathematical appendix considers the case of two types of firm differentiated by the magnitude of their hiring costs.

the firms now retain labour in anticipation of the initial upturn.⁸¹ The result, shown in the right-hand side of the table, is a loss of jobs in recession less pronounced compared with the first scenario and a larger productivity shortfall. During the upturn, the non-hoarding firms rehire and the overall productivity shortfall diminishes as the utilisation of overhead and hoarded variable labour improves.

Wage moderation may affect employment, thirdly, by encouraging businesses to adopt more labour-intensive *production techniques*. The impact would be limited by the possibilities for retrospective change – the substitution of labour for capital, for example – and by the timescale involved in the relevant investment decisions. But some change of technique towards greater labour intensity may nevertheless occur at the margin. In addition, firms that were already relatively labour intensive may gain a competitive advantage over rivals: the displacement of the relatively capital-intensive would orientate the economy towards a more labour-intensive form of expansion.

Accounting for the jobs revival

We now consider how this analysis sheds light on the job creation seen since 2009. Table 12 shows the change in jobs over this period both nationally and split into three broad sectors: a largely government dominated sector (including education and health), a high-productivity sector, comprising goods and service sectors with an above-average level of output per worker, and a low-productivity sector, comprising goods but mainly service sectors with a below-average level of output per worker.

The high and low productivity sectors each account for about 35% of the nation's employment but its increase since 2009 comes solely from the expansion of jobs in the low-productivity sector, as Chart 14 shows. Within the 300 thousand jobs created nationally over this period, 160 thousand jobs were lost in the government-dominated sector,⁸² and 90 thousand were lost in the high-productivity sector.

In sharp contrast, 550 thousand jobs, split roughly equally between men and women and full-timers and part-timers, were added in the low-productivity sector. Two hundred and thirty thousand jobs were created in administrative services, such as office cleaning and call centres, which mainly support businesses.⁸³ An additional 120 thousand jobs came in recreational and personal services, like fitness coaches and undertakers. Cafes, restaurants and to a lesser extent hotels employed an extra 110 thousand people.

⁸¹ Tucker (2011) posits a variant scenario in which hoarding firms are also over-optimistic.

⁸² This loss is less than the loss of public sector jobs (some 400 thousand) mainly because of the expansion of jobs in the private education and (especially) health sectors and the absorption of former public sector workers with transferable skills.

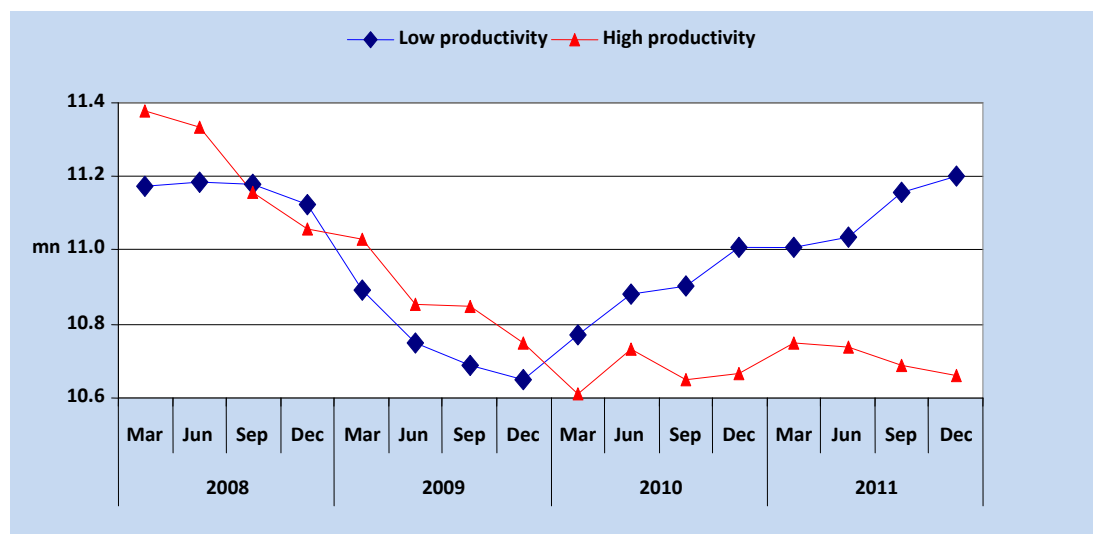
⁸³ According to the Workforce Jobs (WFJ) data published regularly by the ONS, the increase in jobs in the low productivity sector was 460 thousand (cf. 550 thousand), of which 180 thousand (cf. 230 thousand) occurred in basic support services. The published data are not suitable for productivity analysis, however: the ONS allocation of the WFJ employees according to industrial classification differs from that used for output (see appendix). The estimated proportions of extra low-productivity sector jobs taken by men and women (61% and 39%) and by full-timers and part-timers (48% and 52%) are based on the published WFJ data. Compared with the Labour Force Survey in which respondents self-classify, the WFJ data indicate fewer extra full-time jobs nationally over this period and more part-time jobs, with contracted hours of less than 30 a week. On LFS definitions, a proportion greater than 48% of the extra low productivity sector jobs might therefore be regarded as full-time.

Table 12: Broad sectoral employment recovery

National and sectors (share of national jobs at end-2009)	Output per job, % shortfall*	Change in jobs Dec 2009 to Dec 2011 Thousands (rounded)	----- Growth -----	
			% p.a.	cont. % points
Total		300	0.5	0.5
of which (jobs share, %)				
Government-dominated (29)	n.a.	-160	-0.9	-0.3
High productivity (36)	10.4	-90	-0.4	-0.1
Low productivity (35)	6.3	550	2.6	0.9

Sources and notes: ONS, authors' calculations. * at 4Q 2009 based on extrapolated trend (see Table 5 notes). The government-dominated sector mainly comprises public administration, defence, education, health and social services. Also included is real estate, where the measure of labour intensity is distorted by the imputed rents of owner-occupiers included in output for which there is zero labour input. For this reason, the productivity gap is misleading and not reported. Relatively high (low) labour productivity sectors are those with 2008 ratios of gross value added to labour employed above (below) the average for these sectors taken together. The low-productivity sector includes agriculture, distribution, accommodation and food services ("hotels & restaurants"), business support services, arts and recreation, and personal services. The high-productivity sector includes mining, utilities, manufacturing, construction, transport services, information and communications, financial intermediation, and professional, scientific and technical services. The jobs data are derived largely from businesses' payrolls ("Workforce Jobs") based on ONS Reporting Units (see appendix for explanation) but scaled so that their sum aligns with Labour Force Survey estimates of jobs, allowing for workers with second jobs.

Chart 14: Low and high productivity sectors employment



Sources and notes: ONS, authors' calculations. See notes to Table 12.

The broad pattern of private sector job creation fits with the characteristics of the low and high productivity sectors. Both have overhead and variable labour. But the incentive to hoard variable labour is likely to be greater in the high-productivity sector, granted similar prospects for recovery and real wages. Although needs vary, high-productivity sector firms tend to be more reliant on people with advanced skills, and would therefore tend to face rehiring costs larger than those faced by firms in the low-productivity sector.⁸⁴ If strong, these incentives would incline high-productivity sector firms more so than low-productivity sector firms to hoard labour in recession. By the same token, the low-productivity sector would need to rehire during recovery.

Shortfalls in productivity are consistent with this analysis. By the fourth quarter of 2009, the productivity shortfall measured against the extrapolated pre-crisis trend was much greater in the high-productivity sector than in the low productivity sector, as Table 12 shows.⁸⁵ This difference suggests a greater retention of jobs in the high-productivity sector both to meet minimum needs and in expectation of recovery.

If so, both overhead and variable labour in the high-productivity sector would have been under-utilised, and initial recovery of output would not necessarily have required the recruitment of more labour. Instead, recovery would have tended to be relatively jobless, but characterised by rising productivity as the utilisation of both overhead and hoarded variable labour improved. This broadly fits the facts.⁸⁶

In the low-productivity sector, by contrast, the shortfall in productivity suggests much less under-utilisation of labour. The under-utilisation may have been confined largely to overhead labour. Compared with the high-productivity sector, the shortfall of output was smaller but the shortfall of jobs larger. If under-utilisation were confined to overhead labour, the low-productivity sector would have had need of extra labour to meet a recovery of demand. This also fits the facts, although more needs to be said.

Table 13 shows the composition of the post-2009 increase in jobs created in the low-productivity sector and average rates of growth of output and productivity. It is not difficult to explain the large increase in jobs in administrative services that mainly support other businesses. The jobs increase came with a spectacular rebound in activity: despite a deceleration in 2011, basic business services apparently grew over the two years by in excess of 8% a year. This rebound followed an equally spectacular collapse during the recession as other businesses contracted and sought economies.

The sequence of events can be compared with the actions of a vertically integrated firm that, in recession, sheds as many staff as possible performing basic administration and rehires replacements during recovery. The rebound in activity in these support services led to a predictably strong recovery in productivity, which in a vertically integrated firm would be regarded as part of a normal cyclical pattern.

⁸⁴ See Appendix C: Characteristics of low and high productivity sectors. Real consumption wages have fallen well below extrapolated pre-crisis trends in both sectors.

⁸⁵ This large difference is not due to the special circumstances of the financial sector: its productivity shortfall in 4Q 2009 was the same as the high-productivity sector average.

⁸⁶ Between the final quarters of 2009 and 2011, output per job rose by 1.8% a year, and double that excluding two sectors - mining and financial intermediation - where output continued to fall sharply, causing further under-utilisation of overhead labour. Productivity also fell in utilities, where output declined over the period but jobs expanded in response to environmental policies.

Table 13: Low-productivity sector jobs recovery, output and productivity

Low-productivity sector & sub-sectors	Share, %, of extra low-productivity sector jobs Dec 2009 to Dec 2011	Growth, %, p.a. 4Q 2009 to 4Q 2011	
		Output	Productivity
Low-productivity sector	100	1.9	-0.4
of which:			
Administrative support services	43	8.4	3.4
Recreation & personal services	22	1.1	-2.5
Hotels & restaurants	20	2.0	-0.7
Wholesale & retail distribution	11	-0.2	-0.6
Agriculture, forestry, fishing	5	-3.4	-4.9

Sources and notes: ONS, authors' calculations. See notes to Table 12. Productivity is measured as output per job. The sub-sector statistics are of dubious quality. Those for recreation and personal services include measures of activity that the ONS is likely to continue to regard as experimental (Stephens (2012)).

The expansion of jobs in business support services accounted for over 40% of the post-2009 jobs recovery in low-productivity sector jobs. Recreational, personal, hotel and restaurant services taken together accounted for a similar proportion, but unlike the case of support services, the rise in jobs apparently outstripped the (modest) rise in output. Productivity fell. It also apparently fell in distribution and agriculture, sectors characterised over this period by weak or declining activity. These sectors accounted for a minor part of the jobs revival. Note should be taken of the dubious quality of the statistics, but their depiction of the direction of travel may be broadly correct.

That direction is the creation of low-paid jobs. Typical annual earnings of full-time employees in the lowest paid sector – the hotel and restaurants trades – amounted to £16,000 in 2011, about 60% of median earnings economy-wide.⁸⁷ On this measure, the best-paid full-timers in the low-productivity sector were those offering personal services, where median pay was nearly 90% of the national figure. Average pay of all full-time employees in the low-productivity sector other than business services was 80% of the national average; for the many part-time workers it was under 70%. Those engaged in basic business services were only slightly better off.

These jobs developments are broadly what would be expected in a demand constrained economy with plentiful supplies of cheaper labour. Low real wages helped to promote labour-intensive expansion in a variety of already low-productivity service trades. The effect was large enough to depress productivity growth in the low-productivity sector as a whole, even though productivity in the provision of business support services rebounded as demand recovered.

Productivity pessimists point to the post-2009 jobs revival as evidence against the demand-side explanation of weak productivity. We strongly contest that challenge:

- The pessimists' argument that a jobs recovery is incompatible with a shortfall in productivity ignores the impact of overhead labour, under-utilised by firms like those in business support services that weather recession by shedding variable labour, and then rehire in recovery.

⁸⁷ Source: Annual Survey of Hours and Earnings, November 2011.

- The post-2009 expansion of jobs outside of government-dominated activities arose predictably within that part of the private sector that had less incentive to hoard variable labour but more to gain from cheap labour.

In general, the demand-side explanation appears to offer a plausible account of the low level of economy-wide productivity and its shortfall from the previous trend. Supply pessimists, however, prefer structural explanations to which we now turn.

Productivity shortfall – supply-side explanations

The case presented by supply pessimists comprises, first, a list of influences that allegedly have damaged productivity and, second, ancillary evidence - banking crises studies, the economy's inflation performance and business surveys - that, it is claimed, points to the presence of supply constraints.

Consideration is given first to the list, which has evolved in a way that often defies full quantification. We bring to bear such evidence as exists to assess whether the list of influences can plausibly explain why the economy's underlying productivity should have already sustained a severe, sudden and irreparable loss.

Possible structural causes of productivity impairment

Distilled from mainly official reports and speeches, structural explanations for weak productivity can be considered under four headings:

- The contraction of high-productivity sectors, notably banking.⁸⁸
- Weaker capital stock growth as business investment fell.⁸⁹
- Loss of skills due to unemployment and less job-related training.⁹⁰
- Less innovation due to fewer new company formations, credit constraints and the inefficient allocation of financial capital.⁹¹

The contraction of high-productivity sectors

The first hypothesis is that the large shortfall in economy-wide productivity is due to the secular contraction of some previously high-productivity sectors, notably banking but also oil and gas extraction. In addition, it is argued that shifts in employment towards lower productivity sectors may have pulled down the national average. The hypothesis can be tested by an examination of sectoral productivity developments and an accounting exercise that traces the impact on national productivity.

⁸⁸ See, for example, Weale (2009); HM Treasury (2009), Box B4, p195; HM Treasury (2010a), Box B4, p163; OBR (2010), p76; Dale (2011); Giles (2011; 2012).

⁸⁹ See, for example, Barrell (2009); OBR (2010), p76; Barrell and Kirby (2011), Bank of England (2012a, p29; 2012b, p30).

⁹⁰ See, for example, Weale (2010); Barrell and Kirby (2011); Bank of England (2012b), p30.

⁹¹ See, for example, Haugh et al. (2009); OBR (2010), p76; Bank of England (2011c, p31; 2012a, p29; 2012b, p30); Broadbent (2011); Dale (2011), OBR (2011), p54.

The main challenge is the highly dubious quality of the detailed sectoral figures. Problems arise in the measurement of both output and jobs and in tying the two together. Especially questionable are productivity data for the construction industry (not regularly published), the public sector, all of finance and parts of professional, recreational and personal services.⁹² The published productivity data for the real estate sector are rendered meaningless by the inclusion of imputed rents that owner-occupiers are deemed to pay to themselves, but without any associated labour input. For these reasons, detailed sectoral productivity data cannot withstand close scrutiny and are used here solely to gain a sense of broad patterns and orders of magnitude.

Table 14: Productivity growth – sector detail

Annual average growth, %, unless stated	Before Peak	Since peak to 4Q 2011	Change % points
Whole economy:			
Output per hour	2.0	-0.3	-2.3
Output per worker	1.7	-0.8	-2.5
Output per job	1.8	-0.8	-2.6
Economy excluding real estate			
Output per job	1.9	-1.1	-2.9
of which (share of whole economy*):			
Agriculture, forestry & fishing (1)	2.3	-6.0	-8.3
Mining (3)	-3.4	-7.9	-4.5
Electricity & gas supply (1)	-0.7	-9.4	-8.7
Water supply & waste management (1)	1.1	-6.4	-7.5
Manufacturing (10)	4.2	1.6	-2.7
Construction (8)	0.5	1.2	0.7
Wholesale & retail distribution (11)	3.0	-0.6	-3.5
Transport (5)	1.0	-2.5	-3.5
Hotels & restaurants (3)	1.2	-1.5	-2.7
Information & communication (6)	3.2	1.4	-1.8
Finance & insurance (9)	6.5	-1.4	-7.9
Professional services (7)	3.6	-1.8	-5.4
Administrative support services (5)	1.2	-1.7	-2.9
Government-dominated sectors (19)	0.6	0.3	-0.3
Recreation (2)	-0.1	1.0	1.1
Personal services (1)	-0.8	-0.5	0.2
Memo:			
Banking (7) **	6.5	0.8	-5.7
Insurance and other finance (2) **	6.6	-3.6	-10.2

Sources and notes: ONS, authors' calculations. See notes to Table12 and Appendix C: Characteristics of low and high productivity sectors. "Before cycle peak": seven years ending 1Q 2008; "Since cycle peak to 4Q 2011": period from 1Q 2008. * 2008 share, %, of gross value added. ** "Banking" - Division 64 of the Standard Industrial Classification - includes building societies and unit and investment trusts. "Insurance and other finance" - SIC Divisions 65 and 66, includes auxiliary services like fund management. Main sectors' output per job is measured using ONS-supplied high precision gross value added indices and "productivity jobs": largely business payroll-based jobs estimates scaled to align with Labour Force Survey estimates of whole-economy jobs, including workers with second jobs. To estimate the finance and insurance sector split, we emulated detailed ONS methodology. For the provision of data and advice on methodology, we are indebted to Mr John Appleton, Mr Harry Duff, Mr Mark Franklin, Mr Steffan Hess and Ms Ainslie Restieaux.

⁹² See van den Brink and Anagboso (2010); ONS (2010); Stephens (2012).

With that strong qualification, Table 14 shows average rates of growth of output per job before and since the business cycle peak. It is self-evident that the productivity shock is not confined to oil and banking: 14 out of the 17 sectors identified record a drop in productivity growth. Those sectors that record an increase rank amongst the most unreliably measured. Compared with both mining (which includes North Sea oil extraction) and banking, five sectors (including insurance and auxiliary financial services) experienced a comparable or larger reduction in productivity growth.

The reductions in productivity growth are not equally spread. Those for services appear to follow a pattern: the largest reductions affected the hottest pre-crisis productivity sectors.⁹³ This is also true of output growth: the faster the pre-crisis rate of output growth, the larger the apparent fall. The same pattern is not repeated in the primary and goods producing sectors, however, so that across the economy as a whole, the hero to zero productivity rule does not appear to apply.

To gauge the overall impact, productivity shortfalls measured against the pre-crisis trend can be calculated for each sector and apportioned according to each sector's importance to the wider economy. The apportionment can be achieved by reference to a sector's share in national output – output weights – or to national employment – employment weights. There is something to be said for both methods.⁹⁴ On a one-for-one basis, the use of output weights as compared with employment weights gives more emphasis to the impact of relatively high productivity sectors, since, by definition, their share of national output exceeds their share of employment. Conversely, use of employment weights gives more emphasis, one-for-one, to the impact on the national average of relatively low-productivity sectors.

In addition to these direct impacts, national productivity is affected indirectly as jobs shift between high and low productivity sectors. A shift from a higher to a lower productivity sector would reduce national productivity, other things equal. Officials and others seeking to explain why the financial crisis might have materially damaged trend productivity initially placed considerable emphasis on the impact of the shift away from the “high-productivity” financial sector.⁹⁵ As an appendix explains, the impact of shifts in jobs between sectors can be calculated at the national level in a way that is independent of the choice between output and employment weights.

The arithmetic gives rise to a residual – that part of the national productivity gap left over once account has been taken of sectors' direct contributions and the indirect effect of shifts in jobs between sectors. The residual reflects a mixture of direct and indirect impacts and its size depends on the weighting method used.

⁹³ The Bank's February Inflation Report makes this observation, although its chart ill-advisedly includes output per hour growth in the real estate sector (Bank of England (2012a), p28, Chart B).

⁹⁴ In a detailed review, Foster et al. (2001) state, “For labour productivity, the seemingly appropriate weight is employment” since it yields “a tight measurement link” between parts of an industry and the industry as a whole. The authors note practical advantages of using output weights.

⁹⁵ See, for example, OBR (2010), p76; Weale (2009). In a change of view, Weale (2010) concludes, “... rebalancing is likely to have a positive effect on the level of GDP ...”.

Table 15 begins by highlighting the impact of shifts in jobs between high and low productivity sectors. The impact is insignificant. In 2011, it contributed ¼ percentage point to a 10% shortfall in output per job at the national level. (The national figure excludes the real estate sector, where the data are seriously distorted.) The negative impact was only a little larger in 2010 – a ½ percentage point decrement.

Contributing to this small impact is the rise, relative to trend, in the share of employment in manufacturing, where the historic trend points to a fall larger than observed. Employment share of the utilities also rose. Utilities and manufacturing are both relatively high-productivity sectors. These shifts offset the impact of the fall in jobs in banking, where jobs had not previously grown, and the modest rise in the employment share of professional services, previously a more job-generative sector.

Table 15: National productivity gap – sectoral job shift and other impacts

Output per job gap, % *	2009	2010	2011
Whole economy	-7.3	-7.2	-8.8
Whole economy excluding real estate	-8.2	-8.2	-10.0
of which contribution:			
Job shift impact	-0.3	-0.4	-0.2
Direct and mixed impacts	-7.9	-7.9	-9.3
Memo: % output			
Implicit national accounts discrepancy	0.0	0.2	-0.5

Sources and notes: ONS, authors, calculations. See notes to Tables 14. * Actual productivity less trend productivity, as per cent of trend. The trend national level is an extrapolation of the 1Q 2008 level using the average rate of growth in the seven years to 1Q 2008. Trend output and jobs at the sector level are similarly projected but constrained, by scaling, to align with national totals excluding the real estate sector. The scaling has very little effect on sectoral gap estimates. The sectors considered are shown in Table 16. Real estate is excluded because the imputation of rents to owner-occupiers seriously distorts the productivity record. The job shift impact captures the effect on national productivity of shifts in employment, relative to trend, between low and high productivity sectors. The direct impact is the productivity gap in each sector weighted by trend output share or employment share. Mixed impacts are a combination of job shift and direct impacts. The across-sector sum of impacts is equal to the national (excluding real estate) total apart from the implicit national accounts statistical discrepancy (output based). Totals are also subject to rounding error.

Table 16 turns to the direct impact on national productivity of sectors' productivity shortfalls. The main left-hand column shows the result of using output weights: the direct contribution of each sector's productivity shortfall is calculated as the product of the shortfall and the sector's share in trend output. The main right-hand column shows the results of using employment weights: the direct contribution of a sector's productivity shortfall is calculated as the product of the shortfall and the sector's share in employment. A comparison of the two sets of calculations reveals similarities and differences.

There is a difference at the national level, with the output-weighted direct impacts accounting for a larger part of the total shortfall. Using output weights, the direct impacts account for 9½ percentage points of the national (excluding real estate) 10½% productivity shortfall in the final quarter of 2011. The remaining 1 percentage point comprises a statistical discrepancy in the national accounts, the minor indirect job shift impact and the residual impact, a mixture of the direct and indirect impacts.

The arithmetic works out differently using employment weights because the shortfall arising from the residual mix of direct and indirect impacts is larger. In total, the direct impacts based on employment weights account for 7% percentage points of the 10% national productivity shortfall.

Table 16: National productivity gap – sectoral direct and other impacts

Output per job gap in 4Q 2011 % and percentage points	----- Direct contribution using -----	
	Output weights	Employment weights
Whole economy	-9.1	-9.1
Whole economy excluding real estate	-10.4	-10.4
of which contribution:		
Statistical discrepancy, % output	-0.6	-0.6
Job shift impact	-0.3	-0.3
Mixed impact	-0.1	-1.8
Direct impact	-9.4	-7.7
of which:		
Agriculture, forestry & fishing	-0.2	-0.4
Mining	-0.3	-0.0
Utilities	-0.7	-0.3
Manufacturing	-0.9	-0.8
Construction	0.2	0.2
Wholesale & retail distribution	-1.5	-1.9
Transport	-0.6	-0.6
Hotels & restaurants	-0.3	-0.6
Information & communication	-0.4	-0.3
Finance & insurance	-2.4	-0.9
Professional services	-1.6	-1.3
Administrative support services	-0.5	-0.8
Government and other services	-0.1	-0.1
Memo:		
Banking	-1.5	-0.3
Insurance and other finance	-1.0	-0.6

Sources and notes: ONS, authors' calculations. See notes to Tables 14 and 15.

More important is the similarity of the two sets of calculations: each shows that negative productivity impacts are spread widely across sectors. In particular:

- Of the 14 sectors identified,⁹⁶ only the poorly measured productivity gap in the construction industry is positive;
- The majority of impacts lie between zero and minus one;
- The negative impacts of just two sectors – distribution and professional services – exceed the majority regardless of the choice of weighting method.

⁹⁶ In contrast to Table 14, the utilities are treated as one sector and government, recreation and personal services sectors are aggregated.

The main difference between the two sets of calculations concerns the impact of the productivity shortfall in banking. Using the output weight, the impact is minus 1½ percentage points; using banks' employment weight, the impact is minus ¼ percentage point. The difference reflects the apparently high level of productivity in banking: the output weight is much larger than the employment weight.

The output-weighted calculation is the much less trustworthy of the two, however. It is widely argued that the output of the banking sector is overstated as a result of the way statisticians infer much of banks' value added indirectly from the difference between banks' deposit and loan interest rates. The correct figure for banks' inferred output could be half the official estimate.⁹⁷ With that correction, the negative output-weighted impact would be reduced by about a third, placing it in the same range as the majority of negative impacts attributable to other sectors. For this and other reasons,⁹⁸ the employment-weighted estimates provide a more reliable guide.

The hypothesis is thus rejected. The decomposition of the national productivity shortfall reveals it to be a widespread phenomenon, not largely confined to mining (which hardly registers) or to banks. The pervasive nature of the sectoral impacts points to a more general explanation.

Weaker capital stock growth

A second hypothesis emphasises the role played by the capital stock. Structurally weaker labour productivity would arise were there to be a permanent decline in the economy's capital stock in relation to labour employed: a fall in the capital-labour ratio. The OBR originally placed considerable weight on this idea, embracing estimates from the influential National Institute of Economic and Social Research.

NIESR argued that the capital-labour ratio would fall as investment declined in response to an increase in the cost of capital. The cost would be driven up by higher risk premiums, the result of more sober risk assessments by financiers of corporate enterprise; those buying corporate bonds, for example. There was a question over the speed with which the capital stock would adjust but in the light of the fall in investment it was the judgement of NIESR and others at the time that "the adjustment of capital stock is taking place relatively quickly".⁹⁹

Whatever the merits of this proposition, it was unlikely that the adjustment of the capital stock would be so rapid as to offer a plausible account of the structural decline in productivity that had allegedly occurred during the contraction. As Spencer Dale notes, it is "largely a matter of arithmetic".¹⁰⁰ Even in the presence of an investment collapse, the capital stock would grow as long as investment exceeded depreciation.

⁹⁷ Appendix A gives further details.

⁹⁸ See Foster et al. (2001).

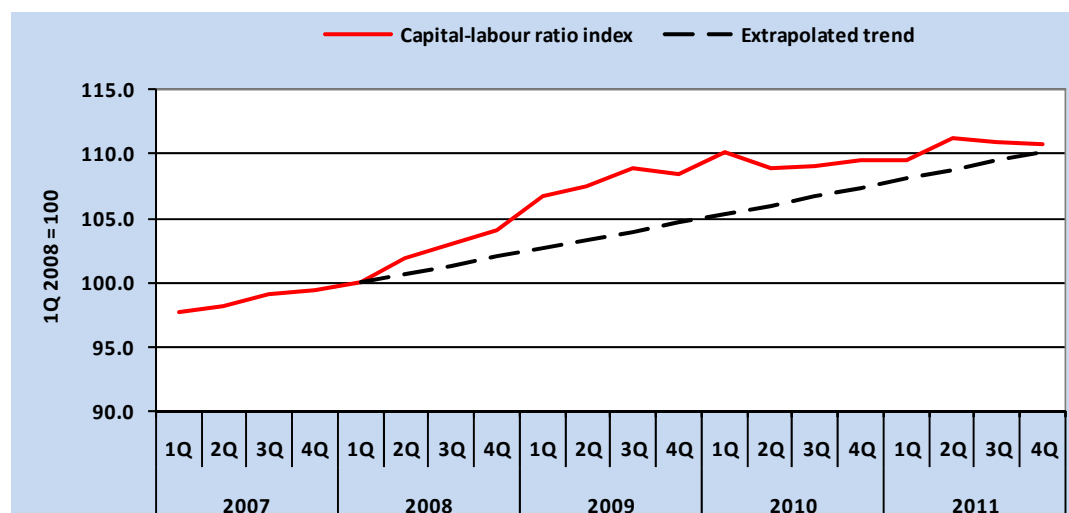
⁹⁹ Barrell et al. (2009).

¹⁰⁰ Dale (2011).

This appears to have been the case. Tentative estimates¹⁰¹ suggest the economy’s non-dwelling capital stock grew by an average 2% a year after 2007, albeit at a slowing pace. If so, the capital stock would by now have decelerated, compared with its pre-crisis trajectory, to about the same extent as labour hours worked. The implication is that the capital-labour ratio would today be roughly “on trend”, as Chart 15 shows.¹⁰² Earlier in the crisis, the shortfall in labour input exceeded the shortfall in capital input, implying a longfall in the capital-labour ratio. Taken at face value, the rise in the capital-labour ratio would have uplifted labour productivity, not depressed it.

One qualification to Chart 15 is that premature scrapping of plant may mean the figures overstate the scale of the remaining capital stock and therefore the ratio of capital to labour. The possibility of accelerated scrapping is emphasised in some explanations of the productivity shortfall, but not universally.¹⁰³ As Dale observes, the rise in corporate liquidations, and so likely scrapping of plant, appears to have been comparatively modest set against the depth of the fall in output. Nor is it clear that premature scrapping would necessarily cause permanent damage. The economy recovered and eventually enjoyed high rates of employment and productivity after the early-1990s recession, despite a probably higher rate of premature scrapping of plant.

Chart 15: Capital-labour ratio – not quality adjusted



Sources and notes: ONS, Kirby and Lisenkova (2012), authors’ calculations. The chart plots an index of the non-dwelling, economy-wide capital stock in constant prices divided by hours worked. The trend is an extrapolation using the average rate of growth of the ratio in the seven years to 1Q 2008. The capital stock figures are a straight-line interpolation of estimates in Kirby and Lisenkova (2012) and the ONS publication “Capital Stocks, Capital Consumption and Non-Financial Balance Sheets, 2010”. Updated dwelling capital stock estimates are inferred from investment flows.

¹⁰¹ Concerned about reliability, the ONS suspended, in March 2012, its regular update of capital stock figures. Earlier ONS figures have been tentatively projected forward using latest NIESR estimates supplemented by own estimates for the dwelling capital stock.

¹⁰² Capital stock per worker on these crude estimates was slightly below-trend at the end of 2011.

¹⁰³ See, for example, Bank of England (2011c), p31; Bank of England (2012a), p29; Dale (2011)

A second qualification to Chart 15 is that the measure of capital does not adjust for the relative efficiency of different capital assets. It would be better to have regard to the volume of “capital services”, a measure of the supply-side role played by investment that gives greater weight to capital assets that achieve a high rate of return.

Boosted by spending on computers and software in the first half of the decade, capital services grew more quickly than the quality-unadjusted capital stock before the crisis, but more slowly afterwards. The official figures, unfortunately available only to 2009, show capital services grew close to 4% a year between 2001 and 2007, but by 1½% a year subsequently. As noted in the earlier study,¹⁰⁴ there was implied a shortfall in 2009 in the capital services to labour ratio. But the likely impact on productivity was minor: a decrement of ¼%. The small impact reflects the importance of capital in driving capacity growth, an importance typically gauged by reference to the share of profits in value added. On standard estimates of this share, it would take a shortfall in the ratio of capital to labour of 3½% to reduce labour productivity by just 1%.

The available evidence does not therefore provide much support for the hypothesis: shortfalls in capital seem unlikely to explain much of the alleged shortfall in underlying labour productivity.

There is, in addition, a fundamental objection to a line of thinking that regards any loss of capital as a permanent supply-side shock, causing irreparable damage to productivity. Much of the fall in investment experienced so far is arguably the result of deficient demand: uncertainty about demand, along with inadequate return, is typically cited by businesses as the major impediment to capital spending. It is unlikely that the cost of capital mechanism proposed by NIESR has yet played much of a role. NIESR’s own estimates show a fall in the cost of capital compared with the pre-crisis level.¹⁰⁵ In principle, a sufficiently robust recovery of demand could reverse any damage arising from a recession-inflicted fall in the capital stock.

Loss of labour skills

A third supply-side hypothesis focuses on loss of labour skills. In February 2011, the Bank of England noted, “some employees are likely to acquire skills as a by-product of their work. Consequently, supply growth may have been impaired following the reduction in employment ... This ‘learning by doing’ channel will lead to a persistent effect on supply if it is difficult for these missed learning opportunities to be fully recovered over coming years.”¹⁰⁶ Those out of work, especially the long-term unemployed, also risk detachment from the labour force and skill obsolescence.¹⁰⁷ Martin Weale calculated that the overall effect could eventually reduce aggregate labour productivity and the trend level of GDP by over ½%.¹⁰⁸

¹⁰⁴ Martin (2011a).

¹⁰⁵ According to the estimates in Kirby and Lisenkova (2012), the average user cost of capital during the 2008 to 2011 period was below the level in the late pre-crisis period and will remain lower in years up to 2016.

¹⁰⁶ Bank of England (2011a), p29. See, also, Bank of England (2012a), p29.

¹⁰⁷ See, for example, OECD (2011); Bank of England (2012a), p26; Dale (2012).

¹⁰⁸ Weale (2010).

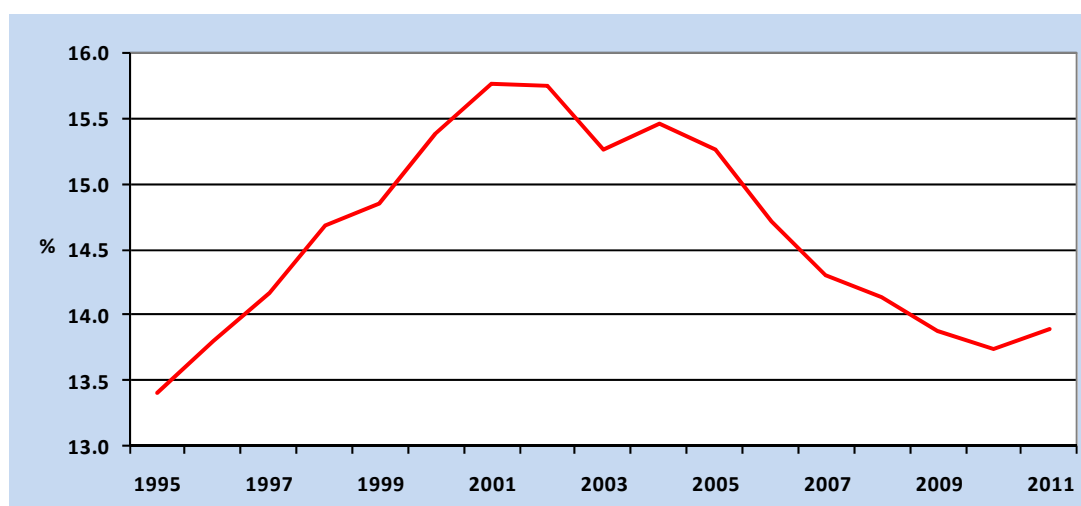
An impact on this scale would account, however, for very little of the projected shortfall in productivity. Furthermore, there is little persuasive evidence to suggest that loss of skills has so far caused material damage.

The Bank's 2011 analysis coincided with the publication of a report from the Centre for Learning and Life Chances in Knowledge Economies and Societies, which concluded that fears of a major decline in skills investment were largely unfounded.¹⁰⁹ The study examined a wide range of survey evidence; including the 2009 National Employers Skills Survey in which three-quarters of employers reported that the recession had not had an impact on the provision or take-up of training.

In cases where there had been an impact, the picture was mixed. One in seven employers had cut back, while others – around one in twelve – had increased training volume. The researchers found that many employers had met what they regarded as “training floors” by improving delivery methods. The most severely affected had, however, “cut training to the bone”, a finding echoed in a parallel study by Geoff Mason and Kate Bishop who found that in “... many establishments’ training plans were essentially blown off course by the recession”.¹¹⁰

Evidence from the official Labour Force Survey suggests that these pressures have abated.¹¹¹ Chart 16 shows that the proportion of employees receiving job-related training recovered last year from a low point in 2010 to a level only slightly below that achieved in 2007. Changes in this proportion over the last few years hardly register in the context of the downtrend since 2001 and 2002.

Chart 16: Employees receiving job-related training, % of all employees*



Sources and notes: ONS, authors' calculations. * aged between 16 and 64.

¹⁰⁹ Felstead et al. (2011).

¹¹⁰ Mason and Bishop (2011).

¹¹¹ Martin (2011a) also drew attention to official estimates that indicated that changes in composition had uplifted the quality of the employed labour force. Updated official estimates are due for release at end-May 2012.

For those out of work, especially for long periods, there is also a risk of labour market detachment and skill obsolescence. As already noted, people who have been unemployed for over a year now represent 2¾% of the labour force, up from 1¼% at the start of the recession. But the impact is unclear. There was a larger increase, from 2½% to 4½%, in the rate of long-term unemployment in the major recession of the early-1990s.¹¹² Treasury estimates of trend GDP growth fell during that recession to a low of 2% a year, but rose substantially in later years as unemployment fell.

If this is a guide, it appears that a long-term unemployment position materially worse than today's did not prevent the early-1990s economy returning to full-employment growth. An analogous point can be made regarding the Bank's concerns about reduced "learning-by-doing" because of lower employment. The post-2007 fall in the employment rate (2¼ percentage points) is considerably smaller than the fall in the early-1990s recession (4 percentage points). Despite a larger implied reduction in learning-by-doing, the early-1990s economy nevertheless recovered satisfactorily.

The strong recovery of demand is one plausible reason why the economy appeared to suffer little long-term damage: the shock that depleted skills may have proved largely transitory in nature, rather than permanent. As in the case of investment in physical capital, fluctuations in investment in skills, whether on training programmes or "learning-by-doing", are not independent of the state of long-term business confidence. In principle, a sufficiently robust recovery of demand could help to repair damage arising from a recession-inflicted fall in the *human capital stock*.

In summary, there is little compelling evidence to suggest any recession loss of skills has permanently depleted the productive efficiency of those in work, or seeking it, on a scale that could plausibly explain that post-2007 shortfall in labour productivity.

Less innovation

Unable to explain the timing and scale of the alleged underlying productivity slump by reference to the demise of one or two high-productivity sectors, shifts in jobs away from high-productivity sectors, the capital-labour ratio or skill impairment, supply-side pessimists have increasingly stressed a fourth hypothesis: the impact of a sclerotic banking system on the pace of innovation.

There are various strands to the explanation. MPC member Ben Broadbent argues that dysfunctional finance may have impeded both the start up of profitable new companies and the demise of old ones, thus slowing the "usual Schumpeterian process of 'creative destruction'".¹¹³ He and the OBR¹¹⁴ cite as evidence an influential study of Japanese banks in the 1990s whose unwillingness, out of fear of regulatory reprisal, to write-off nonperforming business loans allowed unprofitable companies to survive and compete, to the disadvantage of growing companies and potential new entrants.¹¹⁵

¹¹² Early-1990s data from Bank of England (2012b), p28, Chart 3.6.

¹¹³ Broadbent (2011).

¹¹⁴ OBR (2011b), p54, Box 3.1.

¹¹⁵ The commonly cited study is Caballero et al. (2008).

Dale emphasises the damaging effect of credit inadequacy on UK “... smaller companies and new businesses, which are a critical source of innovation in our economy ...”.¹¹⁶ He, like the OBR,¹¹⁷ highlights the impact on research and development spending and notes that “... the amount of management time devoted to raising finance and managing banking relationships has increased very substantially, diverting attention from the search for new products and new markets.”

Little direct evidence is presented to support these contentions; Broadbent describes his analysis as “mostly conjecture”. Other doubts can be raised:

- The reallocative problem that afflicted the Japanese economy in the 1990s is of questionable relevance. The crowding-out of Japan’s innovative companies stemmed from its banks’ excessive forbearance: the “ever-greening” of insolvent borrowers. Small and medium-sized companies in the UK – those most dependent on bank finance – face a problem of excessive rationing, not forbearance. Bank lending to all SMEs has been negative since late-2009.¹¹⁸
- Dale’s assertion that smaller companies and new businesses are “a critical source of innovation in our economy” belies their quantitatively small role in explaining innovation and productivity growth changes and risks perpetuating a view effectively challenged by, amongst others, the OECD in its analysis of growth rate differences and by Alan Hughes, a leading authority on innovation policy.¹¹⁹ He and Andrea Mina emphasise that while SMEs account for over a fifth of business R&D expenditure, nearly all SME R&D “is carried out by the subsidiaries of UK and overseas firms and not by *independent* SMEs”, who are likely to be the most bank-credit constrained.¹²⁰ In 2010, independent SMEs accounted for just 3½% of business R&D spending.¹²¹
- Slow-to-realise payoffs mean that loss of R&D spending cannot plausibly account for the scale and speed of the alleged shortfall in productivity. Studies suggest that a typical R&D project might take one to two years to complete and a further period, ranging from between less than one year to something more than two years, to bring to market.¹²² Slow take-up of new products and processes which may require complementary changes in infrastructure and organisational capital can mean years elapse before even major innovations have a material impact on productivity, a paradox famously illustrated by Paul David’s account of the slow diffusion of electric power technology.¹²³

¹¹⁶ Dale (2011).

¹¹⁷ OBR (2011b), p54, Box 3.1.

¹¹⁸ Bank of England, Trends in Lending, April 2012.

¹¹⁹ Hughes (2007).

¹²⁰ Hughes and Mina (2012).

¹²¹ ONS, “UK Gross Domestic Expenditure on Research and Development, 2010”, March 2012.

¹²² Carson et al. (1994).

¹²³ David (1990).

International perspective

The broad verdict is the same as the one reached in the 2011 study of the supply-side evidence. The evolving list of influences put forward by the OBR, Treasury and Bank of England to explain productivity impairment can plausibly account for only a minor part of Britain's post-2007 productivity shortfall. It is not unreasonable to conclude that the supply-side pessimists are at a loss to explain the scale, suddenness and irreversibility of the structural productivity damage that they allege has occurred.

This sceptical conclusion is reinforced when the same set of explanations is examined in an international context. A full study of the international experience is well beyond our scope, but simple comparison with America and the rest of Europe serves to underline a general point. Since the crisis struck, the behaviour of productivity has varied sharply across the major economies for reasons that likely have little to do with the forces stressed by supply-side pessimists. Probably far more influential are differences in incentives to hoard labour. These incentives have evolved over time and reflect deep changes in corporate objectives and labour market practices.¹²⁴

America today

Attention is rightly focussed on America as a key comparator. Like the UK, the US economy suffered a financial-crisis led slump in activity and business investment. The same supply-side logic that points to structural productivity damage in the UK would predict a similar state of impairment in America. This prediction simply fails: America's productivity has been comparatively resilient.

Productivity was especially strong in the period to 2010. A shake-out of labour during the contraction and subsequent jobless recovery restored productivity to a level by the final quarter of 2010 commensurate with the pre-crisis trend. There followed a period of employment expansion and below-trend productivity growth sufficient to cause a productivity shortfall in the first quarter of this year. It is too early to say whether this is a statistical figment, a temporary feature or a sign of permanent scarring.¹²⁵

As Table 17 shows, the result to date is an average rate of growth in productivity measured in terms of national and private output per person that is a little slower than before the crisis, and a rather larger decline in productivity growth measured in terms of output per hour. The associated shortfalls in productivity appear generally modest compared with the much larger shortfalls in output and with what might have been expected in an economy at the epicentre of the global banking crisis.

¹²⁴ Gordon (2011) more fully develops this theme.

¹²⁵ Bernanke (2012) explains the uneven pattern of productivity advance as the result of fear-driven, and ultimately excessive, layoffs in the contraction. The presence of structural damage caused by recession-induced investment shortfalls is suggested by the latest estimates from the US Congressional Budget Office, which show US productive potential in 1Q 2012 in excess of 3% below the extrapolated pre-crisis trend. Delong and Summers (2012) warn that downgrades to forecasts of potential may simply reflect forecasters' mood swings and, after a review, conclude that the "historical macroeconomic evidence on the existence and size of hysteresis effects is depressingly thin."

Table 17: American output, productivity and real wages

Annual average growth & gaps relative to pre-crisis extrapolated trend	----- Growth % p.a. -----		----- Gap % -----		
	Before cycle peak	Since cycle peak	2010 4Q	2011 4Q	2012 1Q
Whole economy					
GDP	2.4	0.3	-7.5	-8.2	-8.2
Civilian employment	0.9	-0.7	-7.5	-7.3	-6.6
GDP per worker	1.4	1.0	-0.1	-0.9	-1.7
GDP per payroll job	1.8	1.2	-0.3	-1.8	-2.2
Business sector					
Output	2.6	0.2	-9.3	-9.7	-9.7
Output per person	2.2	1.6	-0.5	-2.2	-2.7
Output per hour	2.6	1.5	-1.1	-3.4	-4.1
Real consumption wage					
Wages & salaries	0.3	-0.1	0.5	-1.4	-1.6
Total compensation	0.7	0.0	-0.7	-2.5	-2.8

Sources and notes: BEA, US Bureau of Labour Statistics (BLS), authors' calculations. GDP per worker: based on the number of civilians in employment according to BLS Current Population Survey - comparable to the ONS Labour Force Survey. GDP per payroll job: based on the number of non-farm payroll jobs according to BLS Current Employment Statistics Survey - comparable to ONS Workforce Jobs. The payroll survey excludes the self-employed in unincorporated businesses as well as most agricultural workers. The officially preferred payroll data are the primary source used by the BLS to construct measures of business sector productivity. Real consumption wage: BLS employment cost index (ECI) divided by the consumer price index for all urban consumers. The ECI measure of total compensation includes wages, salaries and employer-provided benefits, such as pensions and bonuses, but excludes stock options. The gaps are defined as in Table 3 but with 4Q 2007 used as the US business cycle peak quarter. "Before cycle peak": seven years ending 4Q 2007; "Since cycle peak": post-peak period to 1Q 2012.

The downside of America's surprisingly strong productivity is the scale of labour market slack. The US unemployment rate, although well below the 10% high seen in late-2009, is still materially above its immediate pre-crisis level. Combined with an usually sharp fall in labour market participation,¹²⁶ the result has been a large decline in the proportion of American adults in work. This slack is widely, although not universally, interpreted as largely cyclical in nature, rather than structural.¹²⁷

If so, the US and UK economies can be seen as having in common a persistent effective demand failure. Uncommon is the way in which the economies have adjusted. In the US, jobs rather than real wages have largely taken the strain. The different behaviours of wages and productivity have nevertheless had a similar result: the protection of business profits. As Chart 17 shows, in the US and in the UK non-financial companies' profitability has been surprisingly resilient.

A brief investigation of the facts and the forces behind these different adjustments is worthwhile. Basic US-UK comparisons are simply stated:

- Despite a smaller GDP shortfall (8% plays 14% in the first quarter of 2012), America has so far experienced a larger rise in the rate of unemployment since the previous

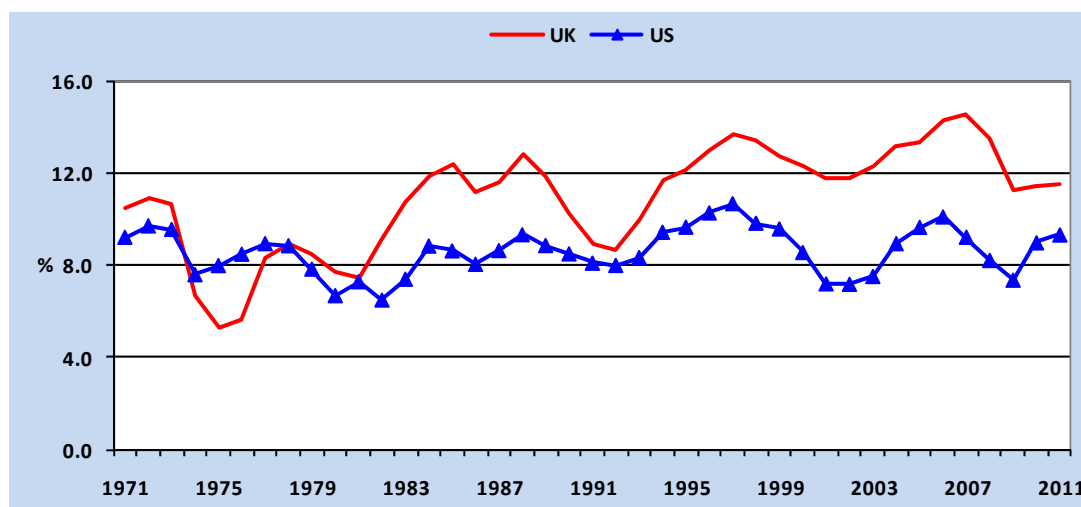
¹²⁶ Aaronson and Davis (2012) estimate that the US participation rate was 1.1 percentage points below trend in late-2011.

¹²⁷ See, for example, Bernanke (2012) and Rothstein (2012b).

cycle peak and a larger fall in the rate of employment. In the period to the first quarter of 2012, the US unemployment rate rose 3¼ percentage points compared with 3 percentage points in the UK, and the US employment rate fell 4¼ percentage points, compared with 2¼ percentage points in the UK.

- The shortfall in employment accounts for a much larger part of the GDP shortfall in the US than in the UK. In the first quarter of 2012, the US employment shortfall accounts for four-fifths of the GDP shortfall. In the UK, the comparable figure is one-third.
- By the same token, that part of the GDP shortfall accounted for by the shortfall in productivity is much larger in the UK than in the US. In the first quarter of 2012, the shortfall in GDP per worker accounts for two-thirds of the GDP shortfall in the UK but only a fifth of the GDP shortfall in the US.
- The massive shortfall in real wages seen in the UK is noticeable largely by absence in the US. By the end of 2010, there was no discernible shortfall in US private sector real wages, as Table 17 shows. A subsequent fall, coincident with the slowdown in productivity growth, resulted in a real wage shortfall of 2% or so in the first quarter of 2012. The UK shortfall was over 16%.

Chart 17: Net rate of return on domestic capital, non-financial corporations, %



Sources and notes: BEA, US Board of Governors of Federal Reserve System, Flow of Funds Accounts, ONS, authors' calculations. For UK data, see Chart 7. US rate of return: operating surplus (Table 1.14, National Income and Product Accounts) as per cent of produced assets at current cost (Table 6.1, BEA Fixed Assets Tables, updated and extended to include inventories using Table B.102, Flow of Funds Accounts). Although based on national accounting concepts, UK and US definitions differ.

What explains these differences? The disparity in real wage adjustments is likely partly to reflect the scale of the demand shocks to which households have had to respond: the shortfall in UK output is much larger than the shortfall in US output. The UK was more

exposed to the banking crisis and has adopted a more restrictive fiscal policy.¹²⁸ The international terms of trade have been more favourable in the US, but this can explain only a minor part of the difference in real wage shortfalls.¹²⁹

It was argued in the previous chapter that the same shocks that produced the shift to greater household thrift in the UK might also help explain why real wages have fallen so dramatically. Over-indebtedness was one factor that may well have encouraged UK workers to accept low pay in return for new or continuing employment.

A shift to greater household thrift is also seen in the US: since the crisis struck, the excess of households' disposable income over their spending has moved from a position of deficit, equivalent to 2% of GDP in 2006, to a surplus worth over 3% of GDP in 2011. As in the UK, a significant number of highly indebted US households are struggling.¹³⁰ However, mortgage debt-to-income ratios of US households in aggregate have fallen more sharply than in the UK, thanks to a much higher rate of default by borrowers and associated write-offs by lenders.¹³¹ Further investigation is required to ascertain whether the ability to walk away from mortgage debt helps to explain the different real wage responses in the US and UK.

The comparative strength of the US productivity response is easier to understand. It can be seen as part of a systemic breakdown in former cyclical relationships between US activity and employment. Fifty years ago, Arthur Okun famously identified a rule-of-thumb relationship that described how a shortfall in US output would be divided on average between higher unemployment and lower productivity. Although the precise division between the two has varied over time,¹³² a version of Okun's Law survived until the mid-1980s. But according to Robert Gordon, the rule-of-thumb subsequently broke down, rendered "obsolete" by a repeated pattern of US labour shedding in recessions.¹³³ The tendency for US productivity to vary procyclically – falling in recession – disappeared, notably in the shakeout and cost cutting seen in the 2001 downturn. The resilient post-2007 productivity response thus has antecedents.

Deep institutional changes may well be responsible for the disappearance of Okun's Law. The advent of shareholder capitalism gradually moved US corporate objectives towards the delivery of high stock market returns, with management rewarded with stock options proportionately much larger in the US than in the UK.¹³⁴ These new incentives combined with a secular reduction in workers' bargaining power: all features of Gordon's "disposable worker hypothesis". Management response to shortfalls in demand thus now places much

¹²⁸ Posen (2012) estimates the cumulative difference in fiscal stance since the beginning of 2007, including the effect of automatic stabilisers, was worth 3% of GDP.

¹²⁹ The US international terms of trade have fallen since 2007 but are above a level implied by the pre-crisis downtrend. The effect would be to raise the warranted real wage relative to trend by a minor ¼ percentage point in 1Q 2012.

¹³⁰ Dynan (2012) finds that US households with the highest (top twenty per cent) levels of mortgage debt in relation to the value of their homes reduced their spending by more than less indebted households. The fraction of the highly indebted in arrears fell only slightly between 2009 and 2011.

¹³¹ See Broadbent (2012) Charts 16 and 17. In a number of US States – "Walkaway States" – insolvent mortgagors may be absolved in certain circumstances from personal liability for lenders' losses arising from defaults on primary, first charge, mortgages not covered by house sale proceeds.

¹³² Knotek, II (2007) emphasises the unstable nature of the Okun coefficients.

¹³³ Gordon (2003, 2010).

¹³⁴ Conyon and Murphy (2000).

greater emphasis on cost cutting and the protection of earnings-per-share to which stock option payments are linked.

In sum, the logical toolkit deployed by supply-siders fails to explain the disparate productivity behaviour of the US and UK, two economies subject to a banking crisis related demand shock. This predictive failure suggests the need for an alternative perspective, one that demotes technology and other supply-side factors as a source of influence and emphasises instead differences in institutional settings and real wage reactions that affect the incentive to hoard labour when demand falls.

America in the 1930s

The same lesson emerges from the debate about the causes of the US slump in the 1930s. Members of the Real Business Cycle School of economists hold to the view that America and, coincidentally, other major economies suffered a decline in technical capability, which in turn triggered the Great Depression.¹³⁵

In this argument, the measure of technical capability is labour productivity, but adjusted to remove the contribution of capital and other inputs: so-called “Solow residual total factor productivity”. The RBC proponents claim that America’s TFP collapsed in the early-1930s as a result of technical regress. The causes of the regress are largely unknown. The RBC position thus finds a close parallel with the views of Bank of England officials who seek to attribute Britain’s poor productivity record to a sudden reduction in the pace of innovation, for which they too lack solid evidence.¹³⁶

The central thrust of the RBC diagnosis of the Great Depression is widely regarded as wrong. Mainstream analysis views the slump largely in terms of a persistent shock to global aggregate demand, thanks to bank failures, poor policy responses, international trade linkages and the insidious effects of the Gold Standard.¹³⁷

The decline in US TFP cited by the RBC school as evidence of technical regress is more widely interpreted as the consequence of under-utilisation of labour. Prior to his appointment as Federal Reserve Chairman, Ben Bernanke together with Martin Parkinson argued that US labour productivity was even more pro-cyclical before World War II than after for reasons unconnected with technological shocks.¹³⁸ Supporting and extending that analysis, Robert Inklaar and others have concluded, “that the hoarding of production factors was the dominant reason for the decline in measured Solow residual TFP in U.S. manufacturing between 1929 and 1933”.¹³⁹

¹³⁵ Kehoe and Prescott (2007).

¹³⁶ Dale (2011) refers to “a slowing in total factor productivity”.

¹³⁷ Eichengreen and Temin (2000) argue that Gold Standard “mentality” shaped key policy makers’ “... interpretation of the Depression and led them to maintain the policies that intensified the economic slump.” European monetary union mentality provides a modern day parallel.

¹³⁸ Bernanke and Parkinson (1991).

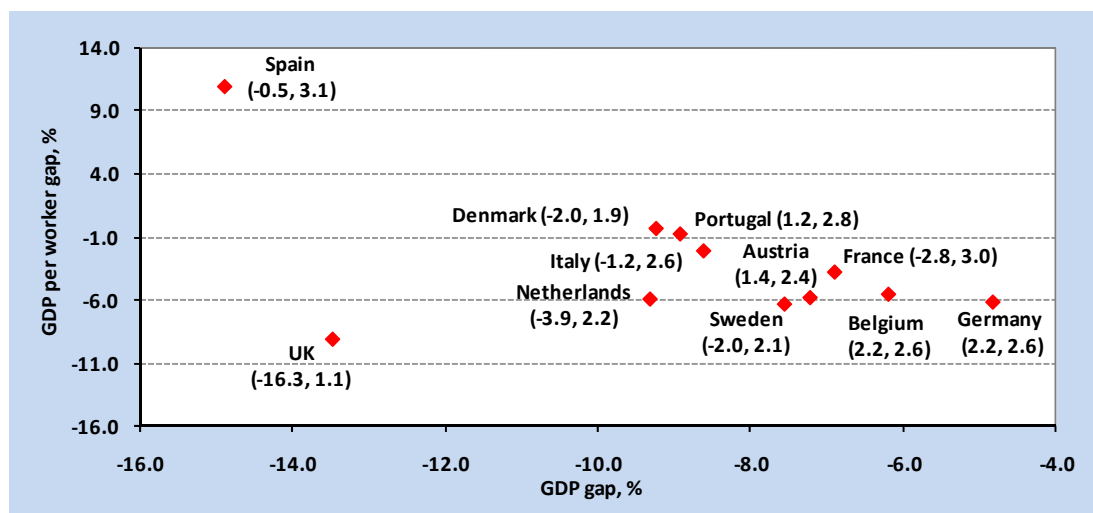
¹³⁹ Inklaar et al. (2011).

Europe today

Strong doubts over the supply-side interpretation are also raised by the behaviour of European productivity. Since the cycle peak, the majority of European economies shown in Chart 18 have experienced slower productivity growth on average, if not outright falls. It seems unlikely that the widespread productivity shortfalls were caused by a sudden, synchronous outburst of technical regress in individual economies. A common demand shock provides a more plausible explanation.

Across most of this European group, productivity shortfalls appear to be related to the size of output shortfalls. If so, the pattern would fit with Gordon's preliminary analysis of the behaviour of output and employment in the European Union.¹⁴⁰ He finds that European productivity moves pro-cyclically, in accordance with Okun's Law, but not in a set fashion. The degree of pro-cyclicality appears to have increased over time, moving in the *opposite* direction to US behaviour, possibly as a result of European government measures to protect workers and encourage job sharing.

Chart 18: European productivity and output gaps (simple trend extrapolation)



Sources and notes: Eurostat, OECD, authors' calculations. Gaps in 4Q 2011 are measured and calculated as in Table 3. The figures in parentheses are, first, gaps in labour costs per hour worked relative to consumer prices, calculated using harmonised indices as a proxy for real wages, and, second, 2008 values for the OECD weighted average index of indicators of employment protection (zero is least restrictive).

It is worth briefly highlighting three special cases within this group of countries:

- The UK stands out as having large shortfalls in output and productivity. It is not possible confidently to discern whether the shortfall in productivity is materially out of line with the European average given the scale of output shortfall but it is of interest that the UK gaps are each about twice the size of the group average (excluding the outlier Spain). The UK is distinctive compared with the European average in having experienced a much greater shortfall in real wages while, at the same time, having a much lower level of employment protection through legislation and collective bargaining agreements. The hint is the UK output-employment

¹⁴⁰ Gordon (2011). His analysis refers to the EU-15 aggregation.

relationship may have followed the European norm as a result of offsetting forces: lower real wages providing the protection for jobs given elsewhere by legislation and custom.

- Spain stands out as having a similar output shortfall to the UK but a *positive* productivity gap: productivity crudely measured by GDP per worker was 11% above a level consistent with the pre-crisis trend at the end of 2011. This longfall is not a sign of spontaneous technical progress but the result of Spain's dual labour market, in which wages change slowly and many workers with temporary contracts are easily dismissed.¹⁴¹ An unemployment rate of 24% is indicative of a demand-constrained economy with disposable workers.
- Germany stands out as the one country in this group in which the shortfall in productivity is greater than the shortfall in output: an employment longfall. It is unlikely that this is a sign of spontaneous technical regress. Michael Burda and Jennifer Hunt attribute much of the German employment "miracle" to the use of working-time accounts to adjust hours of work, rather than jobs, and to pre-crisis under-hiring of labour that arose because firms questioned the durability of the 2005-2007 export-driven expansion.¹⁴²

In sum, international experience further calls into question the plausibility of the supply-side pessimists' narrative. Major economies have adjusted to a persistent global demand shock in ways that reflect differences in corporate objectives and labour market arrangements. The supply-sider's toolkit cannot satisfactorily explain the comparative productivity resilience of a US or a Spanish economy or the widespread productivity shortfall across Europe. It is no more likely now than it was in the Great Depression that economies have spontaneously succumbed to technical regress.

Other evidence of capacity constraints

The preceding sections have critically examined the list of influences cited by productivity pessimists in support of the view that the UK has been severely structurally damaged. The remaining leg of the supply-side case comprises important ancillary evidence, which comes under three headings: first, historic studies of previous banking crises; second, the UK's poor inflation performance and, third, business surveys. This evidence is frequently taken as providing strong and independent proof of the supply-siders hypothesis when all other arguments fail.¹⁴³ We examine the evidence in turn and find each piece wanting.

Crisis event studies

A large number of recent studies have built on earlier work documenting the substantial and long-lasting depressing impact on output associated with major banking crises.¹⁴⁴ Persistent output losses, compared to a previous peak or some measure of trend, of between 5% and 10% have frequently been found across a range of countries. Estimated losses rise close to

¹⁴¹ Wöfl and Mora-Sanguinetti (2011).

¹⁴² Burda and Hunt (2011a, 2011b).

¹⁴³ For example, Dale (2011) who notes: "It is impossible to quantify with any precision the effect that strains within the banking system have had on the growth of productivity over the past few years. But evidence from previous periods of financial turmoil suggests that the effect might be material."

¹⁴⁴ See Martin (2011a) for earlier references. Jordà et al. (2011) report estimates of similar magnitude.

30% when banking and currency crises combine. Such results are frequently cited in support of the view that the UK has already suffered supply-side damage.

This interpretation of history is open to challenge. There is, first, a problem of heterogeneity. Financial crises are highly varied, so it is difficult to speak of a typical response: there is a wide range of estimated impacts including no lasting impact at all. Second, a distinction should be drawn between the impact of banking crises on demand, which will include a possibly large and protracted cyclical element, and on productive potential. Comparatively few studies carefully draw this distinction.

One that does, by Ray Barrell and others, found in the case of systemic banking crises in advanced countries that there was a “large cyclical element of 8.2 percent cumulated losses before a return to trend”, which was depressed by about 4%.¹⁴⁵ Reflecting the heterogeneity of crises, the authors also found that only four of the ten crises studied had “a significant permanent negative effect on output.”

A more recent study presented at a Federal Reserve Bank of Boston conference found similar diversity of impact, but also concluded: “Most severe recessions associated with financial crises in advanced countries do *not* cause permanent reductions in potential GDP” (emphasis added). The adjustment process is found to be drawn out, however: “Among advanced countries, the return to potential GDP following recessions associated with financial crises is much longer than the return following other recessions. It takes an average of 9 years to return to trend following a financial crisis, compared with an average of 1½ years for postwar recessions prior to 2007.”¹⁴⁶

It would be easy for policy makers who believe economies revert quickly to trend to confuse a shortfall in demand and output lasting as long as nine years with the effect of a permanent loss of productive potential.

The third reason for circumspection is that the crisis event studies shed little light on the reasons for any damage to supply. One possibility is that crises cause a downshift in productivity, occasioned, for example, by the reaction of business investors to increased financing costs, as financiers become more risk averse, or by the poor allocation of credit by the impaired financial system. But another possibility is that the depletion of supply is “endogenous” and caused by a prolonged period of demand deficiency that leads, for example, to the permanent scrapping of business capital, the erosion of skills and the detachment from the labour force of the long-term jobless.

A finding that output losses persist following banking crises does not therefore settle the central question – whether the UK’s post-2007 output shortfall represents an ineluctable loss of capacity or the consequences of a general deficiency of demand.

¹⁴⁵ Barrell et al. (2010).

¹⁴⁶ Papell and Prodan (2011).

Poor inflation performance

Since 2007, consumer price inflation has generally persisted at a level above the government's 2% target and above inflation in major competitor countries, a marked contrast to Britain's pre-crisis performance. The Bank's forecasts, conditioned by a belief that spare capacity would reduce inflation, have been too optimistic. A common conclusion is that poor inflation outcomes are indicative of limited spare capacity.¹⁴⁷

This general line of reasoning can be challenged on two grounds:

- The post-crisis increase in inflation was mainly driven by escalating import prices and, in 2011, by the increase in the rate of Value Added Tax. Domestic sources of inflation, which would be sensitive to the level of spare capacity, have been generally subdued.
- There was substantive evidence well before the crisis of a significant weakening of any link between the output gap and inflation. High inflation may well be evidence of a weak relationship rather than of a zero gap.

Table 18 brings out the impact of rising import price inflation, contrasting the period before mid-2007, when sterling was firm in terms of an international trade weighted basket of currencies, and the subsequent period in which the exchange rate fell, settling by mid-2009 over 20% below its 2007 peak. In the earlier period, the appreciation of sterling against the US dollar masked the impact on UK import prices of rising world commodity prices. Subsequently, commodity prices in US dollar terms oscillated wildly, rising sharply until summer 2008, and then collapsing. A renewed upswing had a material impact on UK import price inflation for much of 2011.

Between the two periods shown, the average consumer price inflation rate excluding the statistical impact of indirect taxes rose by about 1¼ percentage points,¹⁴⁸ a similar increase to that registered by prices, excluding indirect taxes and subsidies, for total expenditure in the economy, including spending on exports, government spending and investment. The total expenditure measure of inflation may be used to provide a rough guide to the impact of imported and domestically generated inflation.

Import price inflation rose by 6 percentage points between the two periods and added directly 1½ percentage points to total expenditure inflation, exceeding the actual increase. A moderating effect came from the deceleration in domestic incomes (largely wages and profits) per unit of output: this measure of underlying "domestic"¹⁴⁹ inflation fell by ¾ percentage point between the two periods thanks to a deceleration in unit profits and self-employment income. In the final quarter of 2011, underlying domestic inflation was just 1¼%.

¹⁴⁷ See Martin (2011a) for references.

¹⁴⁸ Inferred from the comparison of RPIX and RPIY inflation in the absence of data on CPIY for the requisite span of years before 2007. According to Bank calculations, the increase from 17.5% to 20% in the standard rate of VAT in January 2011 added mechanically 1.4% to the consumer price level.

¹⁴⁹ Note that exporters' margins are included in "domestic" unit incomes.

Table 18: Inflation and its direct contributors

Inflation, % p.a. and contributions, percentage points	Low inflation pre-crisis period	Crisis period to 4Q 2011
Consumer prices		
All	1.7	3.3
Excluding indirect taxes*	n.a.	2.9
Retail prices excluding mortgage interest		
All	2.5	3.9
Excluding indirect taxes*	2.5	3.6
Expenditure prices excluding net taxes**	2.2	3.3
Of which, contributions, % points (% weight)		
Import prices (27) ***	0.1	1.6
Domestic incomes per unit of output (73) ****	2.0	1.6
Of which:		
Employees' compensation (45)	1.2	1.3
Profits and other incomes (28)	0.9	0.4
Memo:		
Import prices (goods & services)	0.4	6.4
Domestic incomes per unit of output	2.8	2.1

Sources and notes: ONS, authors' calculations. n.a. – not available. Annual average inflation rates calculated from price levels in 2Q 2000 and 2Q 2007 ("Low inflation pre-crisis period") and 2Q 2007 and 4Q 2011 ("Crisis period to 4Q 2011"). *Official price indices CPIY and RPIY. ** Price deflator for economy total final expenditure (consumption, investment and exports) measured at factor cost (our estimate); that is excluding indirect taxes and subsidies. *** Price deflator for all goods and service imports. **** Nominal gross value added divided by the chain volume measure at factor cost including the national accounts residual error to align with expenditure estimates. Profits and other income is nominal gross value added, as defined, less compensation of employees. The contributions are approximately equal to the 2010 weights shown and the inflation rates of import prices and domestic incomes per unit of output. Figures, calculated from an exact identity, are subject to rounding error.

The message is straightforward. The escalation in import prices, associated largely with sterling's fall after 2007 and latterly with higher world commodity prices, was the main direct source of Britain's increased inflation rate. The Bank's detailed analysis supports this conclusion. The UK's poor inflation record does not itself corroborate the view that the economy has little under-utilised capacity. Spare capacity "works", if it works at all, by depressing domestic sources of inflation, which have indeed moderated.

A second question is whether the response of inflation, abstracting from import prices, says anything about the level of capacity under-utilisation. Some have so concluded: the limited deceleration in domestic sources of inflation may be reconciled with the depth of recession if it came with a substantial loss of productive capacity.

But this is not the only, or most plausible, way to reconcile the facts. Evidence amassed well before the banking crisis pointed to a fundamental change in the nature of the inflation process here and abroad: inflation had become less self-feeding and less sensitive to domestic output gaps.¹⁵⁰

¹⁵⁰ See Martin (2011a) for references.

Summarising an array of academic papers, a 2007 study by US Federal Reserve economists noted, “There is general agreement that in many industrial economies, the responsiveness of inflation to domestic resource utilization has declined”¹⁵¹ The statistical relationship between inflation and unemployment – popularly known as the “Phillips Curve” – has therefore changed; in the words of the Federal Reserve study, “the slope of the Phillips Curve has become flatter”.

The UK is no exception: a study by Treasury economists found the normal Phillips Curve relationship disappeared once attention was confined to a low inflation period.¹⁵² Various explanations have been offered. The Bank of England’s Deputy Governor Charlie Bean has pointed to the role played by international specialisation and the impact of monetary policy that better anchored inflation expectations: lower inflation persistence and a flatter Phillips Curve go hand in hand.¹⁵³ The costs of seeking indexation may also outweigh the benefits when inflation is low.

Whatever the causes, the limited response of domestic inflationary pressure to the recession can be readily attributed to a well-documented feature of the behaviour of inflation that prevailed before the crisis rather than to the absence of spare capacity.¹⁵⁴ The shifting nature of the inflation process and the breakdown of statistical relationships have a further important implication: they confound the common practice in which a Phillips Curve is used as a guide to the size of the output gap.¹⁵⁵

Business surveys

Business survey evidence suggests the economy is not suffering from abnormally low capacity utilisation. According to the Bank of England’s regular assessments, surveys indicated the economy began 2011 with a “limited amount of spare capacity”.¹⁵⁶ “Capacity pressures were only a little below average” in the second quarter, although “more spare capacity opened up” in the third.¹⁵⁷ The same surveys suggested capacity pressures were “little changed” in the final quarter of 2011 and in the first quarter of 2012.¹⁵⁸ As shown in Table 6, the OBR’s business survey-based estimate of the output shortfall of 2½% stands in

¹⁵¹ Ihrig et al. (2007).

¹⁵² Dwyer et al. (2010). The coefficients on the level of the output gap were of the “wrong” negative sign (and in one case statistically significant) in regressions for all consumer prices and the goods component, total and core, in the 1997 to 2009 period.

¹⁵³ Bean (2006).

¹⁵⁴ A similar debate is occurring in the US. Ball and Mazumder (2011) attribute the limited response of US inflation during the recent recession partly to a substantial flattening of the Phillips Curve that began in the mid-1980s. One of the paper’s commentators raises the possibility that spare capacity may be less than the authors assume.

¹⁵⁵ Orphanides and van Norden (2005) and Stock and Watson (2007) are examples of studies that conclude that a variety of measures of the output gap (those measured in real time; others measured with the advantage of hindsight and revision) have limited ability to predict inflation. A Phillips Curve relationship is nevertheless used to help gauge unemployment and output gaps estimated by, amongst others, the European Commission, the IMF (its Global Projection Model) and the OECD (D’Auria et al. (2010), IMF (2010a), Beffy et al. (2006)). A similar problem of inference arises from use of Okun’s Law. Evidence of its fragility is summarised in Martin (2011a) and detailed in Gordon (2011).

¹⁵⁶ Bank of England (2011a), p28.

¹⁵⁷ Bank of England (2011c), p30.

¹⁵⁸ Bank of England (2012a, p27; 2012b, p29).

marked contrast to the shortfall of 13½% based on the extrapolation of the pre-crisis output trend.

How reliable are business surveys for the purpose of measuring capacity utilisation? The general answer is probably “not very”. Pockets of capacity shortage reliably measured in certain sectors of the economy may nevertheless coexist with generalised spare capacity.¹⁵⁹ Survey respondents’ notion of capacity is not well defined, and likely to be especially fuzzy in services, which comprise the dominant part of private sector activity. The Bank of England regularly stresses the possible weaknesses. Last November’s Inflation Report noted: “Companies may report immediately available capacity rather than their long-run capacity, and exclude, for example temporarily mothballed production lines.” Other businesses reporting little spare capacity may “need to put in considerable effort to generate output when activity is subdued ...”.¹⁶⁰

The concept of normal capacity envisaged by businesses may therefore differ substantially from economists’ notion of economic potential, which is focussed on the ability of the economy to expand without sharply rising costs while seeking to make best use of resources and technology. An important possibility is that businesses may construe normal capacity in terms of the attainment of their financial objectives, for example, a target rate of return. The real wage moderation which has allowed British firms to perform profitably at below-trend levels of productivity may therefore help to explain the puzzling disjunction between business surveys that indicate close to normal levels of capacity utilisation and the inference, based on trend extrapolation, of a large and persistent shortfall.¹⁶¹

Measures of the economy’s potential derived from business surveys also have a particularly challenging characteristic, as Chart 19 illustrates. The implied growth of economic potential moves up and down in sympathy with the business cycle itself. Large recessions notably come with much weaker estimated potential growth; stronger estimated growth of potential reappears during ensuing recoveries.

Those who struggle to believe that business cycles comprise periods of unusually rapid technical progress or regress in the manner envisaged by the Real Business Cycle school may share Brookings economist George Perry’s suspicion that the apparent cyclicity of economic potential arises from a bias in the way businesses respond to surveys: “respondents “find” capacity when output rises sharply, and “lose” it when output slackens.”¹⁶²

Perry’s observation fits with responses to rare surveys undertaken by the Bank of England’s Agents. In late-2010, at a time when business survey evidence was taken to imply the existence of little spare capacity in the economy as a whole, less than ten per cent of firms specially surveyed by the Agents said they would be unable to meet an increase in demand

¹⁵⁹ Some manufacturing companies specialised in exporting, and their suppliers, may be capacity constrained, for example. It is of note that the volumes of manufactured exports of chemical dyes and paints, pharmaceuticals, non-ferrous metals, transport equipment, and clothing and footwear have grown since the cycle peak at rates in excess of pre-crisis averages.

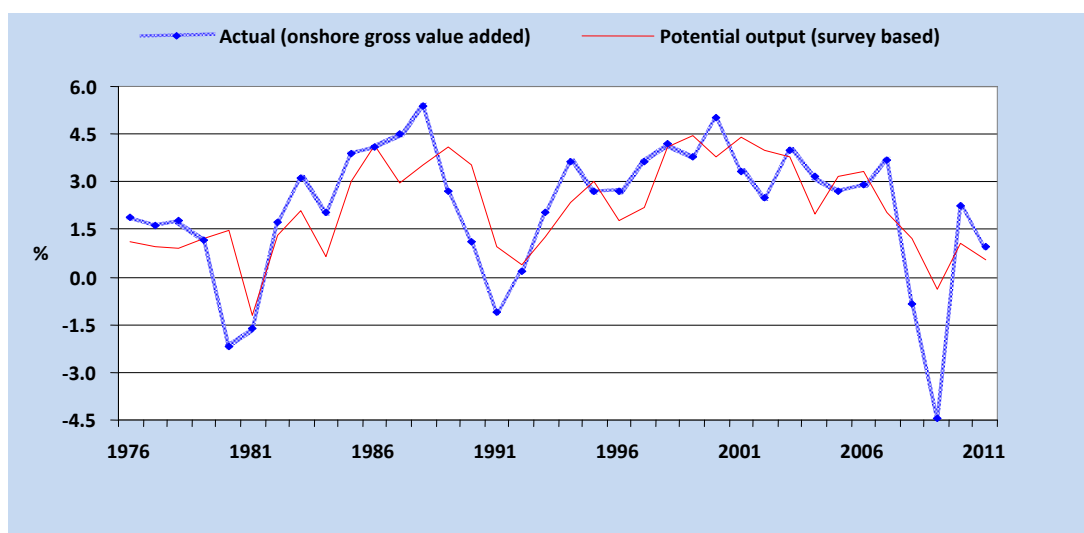
¹⁶⁰ Bank of England (2011c), p30.

¹⁶¹ See Martin (2011a) for a longer discussion and suggestive evidence.

¹⁶² Perry (1973). There is a long-standing debate about the plausibility of fluctuations in technical progress at business cycle frequencies. Mata and Louçã (2009) provide a comprehensive assessment.

using their existing workforce.¹⁶³ In the previous special survey in spring 2010, the comparable figure was under 5%.¹⁶⁴ These responses are consistent with the view that businesses' usual conception of capacity is not only fuzzy but also highly elastic, adapting to the prevailing state of demand.

Chart 19: Actual and estimated potential UK growth, % p.a.



Sources and notes: ONS, OBR (2012), Pybus (2011). See notes to Chart 2.

Those who compile survey-based estimates of spare capacity have a ready defence, however: their estimates are similar to those produced by other methods. The OBR regularly compares its estimates of the output gap with those of international agencies, for example. But the comparison is not a robust test: survey based measures of capacity utilisation are frequently used in alternative estimates of potential output.

The use to which business surveys are put varies. They are regularly deployed, for example, by international agencies that frame their estimates of potential output in terms of a notional production function. To distinguish trend from cycle, a cycle adjustment has to be applied to most of the ingredients of the production function approach – notably the measurement of labour input and underlying productivity. Both the European Commission, as a matter of course, and the International Monetary Fund, in its 2010 UK Country Report, use survey estimates of capacity utilisation to purge a measure of underlying productivity of cyclical variation.¹⁶⁵

Even the output gaps that come from other methods of cyclical adjustment, such as those based on statistical filters, may formally or informally incorporate business survey evidence.

¹⁶³ A little over half said they could raise output by up to 5%; over 15% said they could raise output by more than 10%.

¹⁶⁴ Agent's summary of business conditions, April 2010 and January 2011.

¹⁶⁵ D'Auria et al. (2010); IMF (2010b).

The filters may be chosen on the basis that they help replicate the cyclical pattern revealed by surveys.¹⁶⁶

Echoing George Perry's concern about capacity that is seemingly "lost and found" by respondents to business surveys, the British Treasury has itself expressed unease with production function based depictions of productive potential: "trends generated by the production function approach tend to exhibit a pro-cyclical component (i.e. the cycle does not get fully filtered out), with the result that trend growth estimates display significant changes over relatively short periods."¹⁶⁷

Policy makers are in an unenviable position. The economy's productive potential is unobservable and standard methods of estimation are unreliable. Measurement error, business survey biases, the instability of relationships, such as Okun's Law and the Phillips Curve, used to help pin down estimates of potential are amongst the many reasons why policy makers can have very little confidence in output gap estimates, especially those produced in real time for the purposes of monetary and fiscal policy.

¹⁶⁶ IMF (2011), for example, informally cross checks its Okun's Law estimates of the UK output gap against business survey evidence. More formally, Mc Morrow and Roeger (2001) select amongst competing statistical filters based on their ability to replicate business survey measures of capacity, and find in favour of the Hodrick-Prescott (HP) filter extensively used in potential output estimation. The HP filter is used by the OECD cyclically to adjust underlying productivity, labour force participation and average hours of work and by the EC to adjust labour force participation. The IMF also deploys the survey measure of manufacturing capacity utilisation in its unobservable components model of potential output, which additionally uses Phillips Curve and Okun's Law relationships (IMF (2010a)).

¹⁶⁷ HM Treasury (2008).

Appendix A: Data weaknesses

Output

It is a familiar concern that initial estimates of GDP may understate the pace of activity.¹⁶⁸ Although there is little evidence of downward bias measured over recent years, long-term analysis suggests a tendency for early estimates of GDP to be revised up, a belief that conditions the Monetary Policy Committee’s regular forecasts.¹⁶⁹

It was thus widely expected that revisions due for publication in October 2011 would paint a less severe picture of the recession. The MPC gave precision to a common view in saying, “current and recent levels of GDP are more likely to be revised up than down once the revisions process is complete ... there is just over a three-in-five chance that the current level of GDP will be revised up by more than 1% ...”.¹⁷⁰

In the event, the impact of the October revisions went the other way. While pre-recession growth rates were revised up, the recession itself was reckoned to have been deeper, albeit briefer, than previously estimated. The decline in GDP between the first quarter 2008 peak and the 2009 trough – placed on revision in the second rather than third quarter – was put at 7% rather than 6½%. The downgrade to growth in 2008 was partly offset by upward revisions to growth in 2009 and 2010; growth in 2010 was further revised up in a later release. As Table A1 shows, the net impact so far is to leave broadly unchanged the estimated level of activity in early 2011 relative to the business cycle peak, thus doing nothing to “solve” the productivity puzzle.

Table A1: GDP revisions

GDP growth, % p.a. unless stated	Pre-peak average*	Three years after peak	Index (1Q 2008 =100) 1Q 2011
Publication date:			
June 2011	2.4	-1.4	95.9
March 2012	2.8	-1.5	95.7

Sources and notes: ONS, authors’ calculations. * Seven years to 1Q 2008.

These changes do not preclude the possibility of future upward revisions, however, in line with the long-term track record. The revision history of the early-1990s recession is telling. GDP was initially estimated to have fallen by 4.3% between the 1990 peak and the cycle trough, originally thought to be in the second quarter of 1992. Two years after the initial estimate, the figure had been whittled down to 3.5%. Four years later, during a comprehensive set of revisions, the estimate fell to 2.8%. Three years after that today’s estimate of a 2.5% fall made its first appearance.¹⁷¹ In total, nine years elapsed before the official figures settled down to portray a picture of the early-1990s recession that was far less severe than policy makers feared at the time.

¹⁶⁸ Relevant evidence is given in Brown et al. (2009), Cunningham et al. (2007) and Martin (2010a).

¹⁶⁹ In February 2012, the Bank’s modal growth “backcast” implied cumulatively a level of GDP in 4Q 2011 about 1% above the then-available ONS figure, which was revised down ¼% in March.

¹⁷⁰ Bank of England (2011b), p22.

¹⁷¹ This is true of the period from the 1990 peak to either of the second quarter of 1992 or third quarter of 1991; in official commentary, the latter quarter is now taken to be the trough.

Table A2 shows the possible impact on GDP growth of future revisions, taking the historical pattern as a guide. Also included are allowances for the impact of the exceptionally cold 2010 winter and other erratic factors. The adjusted estimates of annual GDP growth in recent years are between a quarter and a half percentage point in excess of the official record, with a cumulative effect on GDP in 2011 of 1¼%.

Table A2: GDP growth estimates

GDP growth, %	2008	2009	2010	2011
Official estimate	-1.1	-4.4	2.1	0.7
variants:				
(1) GDP after possible revisions, erratic adjusted	-0.9	-4.2	2.5	1.0
(2) GDP with less FISIM	-1.2	-4.3	2.3	0.7
(3) GDP post-2008 chaining (output based)	-1.1	-4.2	2.0	0.7
(4) GDP post-2008 chaining (expenditure based)	-1.1	-4.4	2.1	0.7

Sources and notes: ONS, authors' calculations. (1) incorporates allowance for the long-term pattern of upward GDP revisions (see Martin (2010a)) and ONS estimates (-0.5%) for the impact of the unusually cold weather in 4Q 2010 and the royal wedding and other factors in 2Q 2011. (2) assumes FISIM is 50% of the official estimate for "banks" ("Financial service activities except insurance and pension funding", Division 64 of the 2007 Standard Industrial Classification). In addition to banks and building societies, the Division includes such activities as unit trusts and financial leasing. Based on a 2005 calculation that allowed for current bought-in resources used in its production, FISIM is set by the ONS at about 65% of the Division's gross value added. Halving FISIM reduces the weight of Division 64 in the economy gross value added in 2008 from 6.6% to 4.5%. We are indebted to Mr Hugh Skipper for his explanation of ONS methodology. (3) GDP recalculated from the output side using growth rates of nineteen sectors and previous period sector weights in economy total gross value added. The estimates include the implicit output statistical discrepancy and allow for the distinction between GVA and GDP. (4) GDP recalculated from the expenditure side using growth rates of six expenditure categories and previous period weights in the expenditure measure of GDP. The estimates include the expenditure statistical discrepancy. We owe the idea of testing the impact of chain linking to Mr Nicholas Oulton (London School of Economics).

Two additional sources of possible measurement error are highlighted in the table. The first concerns the value of banks' services that are indirectly measured by the margin banks make on deposit taking and lending. It has been widely argued that official estimates of FISIM (Financial Intermediation Services Indirectly Measured) overstate the true worth of banks' services by falsely including within the margin the compensation that savers receive for bearing risk. A number of studies suggest the correct figure is between about one half and 60% of the official FISIM estimate.¹⁷² If so, the effect of FISIM would be to exaggerate the importance of banking to the wider economy, and therefore the impact of relatively high or low rates of banks' output growth, itself subject to considerable measurement error.¹⁷³

¹⁷² See Martin (2011a) for references. The pre-crisis deterioration in the quality of banks' screening and monitoring services suggests an even lower figure would have been applicable before 2008.

¹⁷³ For example, pre-crisis rates of growth of financial intermediation were probably exaggerated by use of the GDP price deflator to infer volume movements from the growth in the value of stocks of deposits and loans. But there were also sources of understatement of growth, such as the exclusion of hedge funds. Burgess (2011) provides an excellent summary of the measurement issues.

Table A2 shows the effect of setting FISIM at half the official figure. The impact on GDP growth is minor in 2008 (when banking output apparently grew while the rest of the economy contracted) and in 2009 (when banking contracted by more than the rest of the economy). A larger, but still small, uplift to GDP growth occurs in 2010 when banks continued to contract while the rest of the economy recovered. The impact in 2011 is negligible. On this arithmetic, uncertainty regarding the size of the banking sector seems likely to have only a small effect on measured GDP growth.¹⁷⁴

The other source of measurement error highlighted in the table concerns the method of deriving GDP growth as relative prices change. Should a component of GDP grow relatively quickly in volume terms because of a decline in its relative price, the component's share in GDP in value terms would be less than the share implied by volume movements. In this case, adding up volumes would tend to overstate the importance to the economy of the fast growing component and the overall rate of economic growth. It can happen, however, that the relative price and relative growth of a component move in the same direction, in which case adding up volumes would tend to understate the overall rate of economic growth.

Official practice, known as chain linking, allows for shifts in relative prices until a base year, currently 2008, but after the base year derives annual GDP by adding up volume figures. The base year is typically advanced one year each year, so that by 2014 current 2011 estimates of GDP growth should be subject to full chain linking.

Table A2 shows the impact of allowing for changes in relative prices beyond the current base year. Re-calculated from the output side using sectors' growth rates and shares in the economy's value added, GDP fell by a ¼ percentage point less than the official estimate in 2009. The subsequent impact on measured growth is negligible. Re-calculated from the expenditure side, albeit at a high level of aggregation, the impact is zero. Since the expenditure estimates are ultimately given more weight by official statisticians, the conclusion is that full chain linking is itself unlikely to make any material difference to current growth estimates.

Jobs

As with the output figures, the reliability of employment data is open to question. The officially preferred measure of the number of workers and of jobs (the latter including workers with a second job) comes from the Labour Force Survey (LFS) of resident households. But there exists an alternative measure, known officially as Workforce Jobs (WFJ), which uses information from businesses' payrolls. The WFJ private sector employee data are supplemented from other sources, notably LFS estimates of the self-employed and of employees in agriculture and, historically, in construction,¹⁷⁵ and official estimates of public sector jobs. Each year, the WFJ employee figures are revised in the light of a more reliable annual survey, currently the Business Register Employment Survey, which acts as a benchmark.

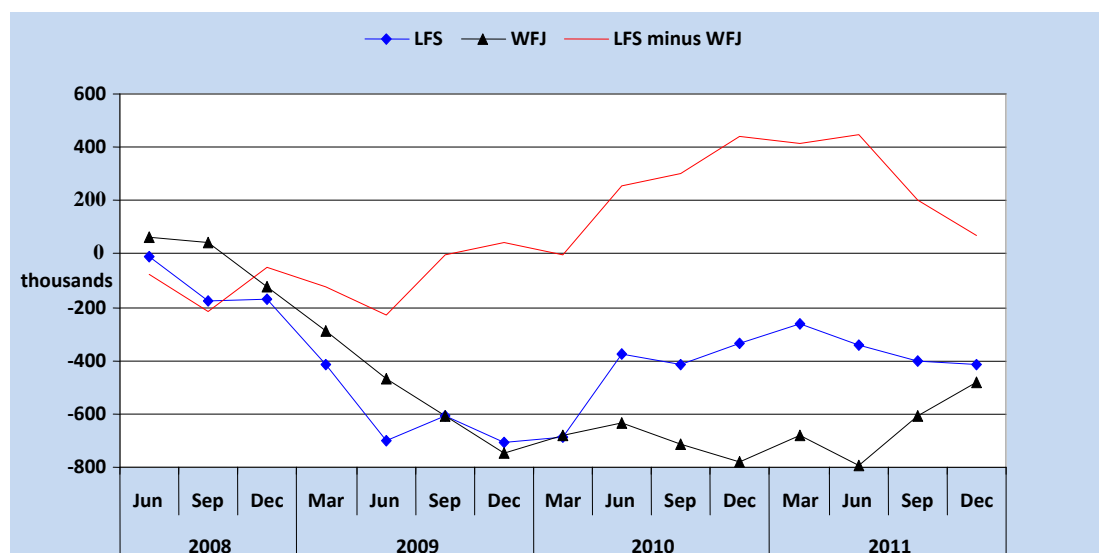
¹⁷⁴ It should be noted that historical rates of measured GDP volume growth are governed by developments in expenditure, not output, and that official statisticians adjust the output estimates to achieve overall alignment. Services sectors' outputs, save retail, were adjusted down by 1.2% in 2008 and up by 0.5% in 2009. The usual tolerance allowed for the difference in GDP growth indicated by expenditure and output estimates is 0.2 per cent (UK National Accounts Blue Book, 2011).

¹⁷⁵ Beginning with data in 4Q 2010, an employer survey is used to provide a short-term indicator of employee jobs in construction.

The number of jobs in the economy according to the LFS regularly falls short of the WFJ estimate: in December 2011, 30.2 million “LFS jobs” played 31.5 million “WFJ jobs”. Were it a constant proportion, this difference would not affect the calculation of growth of jobs and productivity but, regrettably, the difference is both large and time varying, and poses a challenge when interpreting recent job developments.

Chart A1 contrasts the cumulative change from March 2008 in the LFS and WFJ series. By June 2009, the LFS records 230 thousand more job losses than the WFJ, a difference largely eradicated in the remainder of the year.¹⁷⁶ An even larger, but reverse, statistical gap subsequently appears. Although erratic, the LFS series shows a 370 thousand *increase* in jobs between December 2009 and June 2011. Jobs according to the WFJ series *fell* by 40 thousand over the same period. The result is a large cumulative discrepancy compared with March 2008: an LFS jobs loss of 340 thousand plays a job loss of 790 thousand according to the WFJ series, a 450 thousand difference. The discrepancy is largely eliminated in the second half of 2011, a period of job loss according to the LFS but of significant job gain according to the WFJ.

Chart A1: Cumulative change in jobs since March 2008: LFS versus WFJ



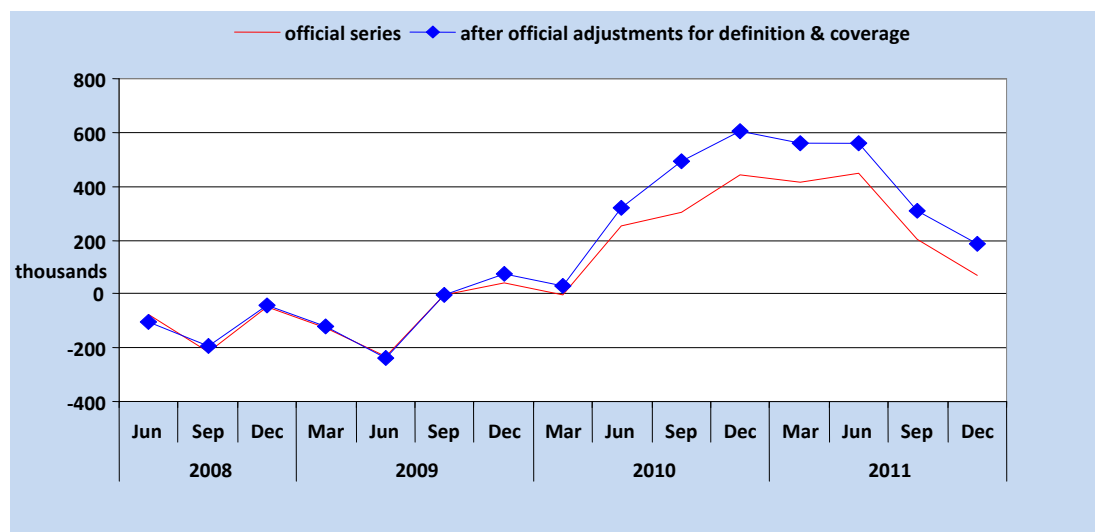
Sources and notes: ONS, authors' calculations.

Over the whole period, then, the rival records of net job loss are similar but the estimates substantially part company during the different phases of contraction and recovery. Can the figures be reconciled? There are, in fact, many possible causes of difference. A voluminous official report in 2006 gives about thirty reasons - sample and coverage differences, for example - a dozen of which the official statisticians attempt regularly to quantify using supplementary, albeit rather dated, information.¹⁷⁷ These adjustments, alas, only deepen the mystery. As Chart A2 shows, the cumulative difference in the LFS and WFJ records is greater with the adjustments than without them. In particular, the change in jobs between December 2009 and June 2011 is raised by the adjustments to the LFS series and diminished by the adjustments to the WFJ series, increasing the discrepancy by about 80 thousand.

¹⁷⁶ Quoted figures are rounded to the nearest 10 thousand.

¹⁷⁷ ONS (2006).

Chart A2: Cumulative change in jobs: LFS minus WFJ with adjustments



Sources and notes: ONS, Phillips (2012), authors' calculations. Changes in recorded jobs are cumulated from March 2008.

Since the estimates are not easily reconciled, it is necessary to choose between them. Official statisticians much prefer the LFS, using the WFJ primarily as a means to allocate LFS jobs data across sectors. The smaller sampling variability of the LFS and systematic upwards revisions to the WFJ data at annual benchmarkings underpinned the official preference in the 2006 report, which blamed the revisions on the WFJ sample estimation method.¹⁷⁸

There are reasons to suppose that WFJ data may have become more reliable. To counter the suspected bias, albeit at the cost of greater volatility, the ONS introduced in 2010 a new method of estimation with effect from the third quarter of 2008.¹⁷⁹ Unfortunately, the revised method did not prevent an upward revision (of nearly 170 thousand) in the subsequent benchmarking exercise, although the statisticians thought the new payroll estimates seemed "more sensitive to prevailing economic conditions."¹⁸⁰ The latest benchmarking added another 60 thousand jobs.¹⁸¹

In the light of these and other considerations, the official preference for the LFS seems justified. But it too is subject to error, which may have become more elevated with increases in cross-border migration.¹⁸² LFS respondents' self-classification as "self-employed" may also, at times, disguise effective unemployment.

¹⁷⁸ WFJ data were compiled using a "matched pairs" estimation procedure in which only the responses of the same businesses were taken into account in successive surveys. It is thought that the exclusion of the births and deaths of businesses in the sample led to an underestimate of changes over time.

¹⁷⁹ The matched-pairs estimator was replaced by a point-in-time ratio estimator (Barford (2010)).

¹⁸⁰ ONS (2011).

¹⁸¹ ONS (2012).

¹⁸² In the reconciliation of LFS and payroll data, the ONS adds an allowance to the LFS series for temporary foreign workers based on "experimental" short-term migration statistics (Machin (2008)).

Appendix B: Mathematical models

By Robert Rowthorn

A model of plant births and deaths

The following model is designed to illustrate the impact of changes in certain exogenous parameters or variables, such as exogenously given wage rates, on the establishment and closure of plants.

The economy consists of a large number of identical plants. Each plant costs K , lasts for a maximum length of time T and must then be scrapped. A plant can be scrapped prematurely if it is unprofitable to continue operating. It can also be mothballed and production suspended for the time being. Before the recession occurs there are n plants in existence and the age structure of plants is balanced, so that each n/T years a plant is replaced. The number of plants is very large so the replacement process is virtually continuous.

To produce Y units of output requires $L = F + bY$ units of labour. There are no other current inputs. The quantity F is overhead labour, which is fixed no matter what the level of output. The only way to avoid this expenditure is to scrap the plant. Output cannot be stored. The recession begins at time 0 and from then onwards the maximum saleable output of each plant $Y(t)$ is determined by exogenous demand. The function $Y(t)$ is continuous for $t > 0$ except at a finite number of points R_1, R_2, \dots, R_N , where the value of $Y(t)$ increases discontinuously by Δ_i . The price of output is unity and the exogenous wage rate is equal to $w(t)$. There are no hiring or firing costs.

There is perfect foresight and future profits are discounted at the appropriate long-term interest rate. This long-term rate is the integral of short-term interest rates.

Profits earned at time t are evaluated at time t_0 using the following discount rate:

$$D(t_0, t) = \exp\left(-\int_{t_0}^t r(s) ds\right) \quad (1)$$

where $r(s)$ is the short-term interest rate at time s .

There are three main choices for an existing plant at time t :

- (i) Close down permanently. In this case profits are given by:

$$\pi(t) = 0$$

- (ii) Mothball the plant and produce nothing for the time being. In this case, F units of overhead labour are employed and profits are given by:

$$\pi(t) = -w(t)F$$

- (iii) Produce just sufficient output to meet existing demand, using the minimum amount of labour required for this task. Employment and profits in this case are given by:

$$\begin{aligned} L(t) &= F + bY(t) \\ \pi(t) &= Y(t) - w(t)L(t) \end{aligned} \tag{2}$$

There are also other possibilities. For example, the plant could produce more output than can be currently sold. Since output cannot be stored, this would be inconsistent with profit maximisation. Alternatively, the plant could produce less than the amount which can be sold. This would normally be inconsistent with profit maximisation.

If $1 > w(t)b$ then each additional unit of saleable output generates a positive profit, so it is profitable to increase output to the maximum level $Y(t)$. Conversely, if $1 < w(t)b$ then each marginal unit of production loses money, so the most profitable course of action is either to suspend production for the time being or to close the plant altogether.

The firm could also employ more workers than it requires for current production. Since workers can be hired or fired without cost, it is never profitable to carry workers who are not currently required.

Condition 1

We shall assume that the following condition is always satisfied:

$$1 > w(t)b \tag{3}$$

This condition ensures that, for any continuing plant, output will be at the maximum saleable level $Y(t)$.

Premature scrapping

A plant will be scrapped once the present value of the optimal future profit stream is no longer positive. This will automatically be the case if the plant has reached the end of its physical life. The decision to scrap a plant prematurely will depend on the present value of its future profit stream.

Consider a plant that is aged $A \leq T$ at time t . Suppose that this plant will be scrapped at time $t + S$, where $S \leq T - A$. For any given trajectory of output and employment, the discounted value of profits is given by the following expression:

$$\int_t^{t+S} D(t, v)[Y(v) - w(v)L(v)]dv \tag{4}$$

The present value of the plant is defined as follows:

$$PV(t, A) = \int_t^{t+\hat{S}} D(t, v)[\hat{Y}(v) - w(v)\hat{L}(v)]dv \tag{5}$$

where \hat{S} , $\hat{Y}(v)$ and $\hat{L}(v)$ are chosen, within the constraints of the problem, so as to maximise the discounted profit stream given in (4). We shall refer to $PV(t, A)$ as the present value of the plant. Since $\hat{S} \leq T - A$ it follows that $PV(t, T) = 0$.

A plant that is age A at time t will be scrapped at time $t + \widehat{S}$ if the following conditions are satisfied:

$$\begin{aligned} PV(t+S, A+S) &> 0 \text{ for } S < \widehat{S} \leq T - A \\ PV(t+\widehat{S}, A+\widehat{S}) &= 0 \end{aligned} \tag{6}$$

The optimal scrapping time $t + \widehat{S}$ is the first point at which the maximum achievable value of the discounted profit stream ceases to be positive. The plant will be prematurely scrapped if $\widehat{S} < T - A$. A downward shift in the trajectory of wages or interest rates reduces the incentive for premature scrapping.

New plants

A new plant can be installed only if it is replacing an old plant that has just reached the end of its physical life. Plants that are prematurely scrapped are not replaced. A new plant will be installed at time t if the cost of the new plant is less than present value of future profits evaluated along the optimal trajectory. This requires that the following condition holds:

$$NPV(t) = PV(t, 0) - K > 0 \tag{7}$$

Dynamic programming

To simulate the above model present values must be calculated. For this purpose we use the method of dynamic programming. This method uses backward recursion based on the following approximate formula:

$$PV(t, A) = \max \left[0, (1 - r(t)\Delta t)PV(t + \Delta t, A + \Delta t) + \widehat{\pi}(t) \right] \tag{8}$$

where $\widehat{\pi}(t)$ is the maximum achievable profit at time t and Δt is a small increment. A plant that is T years old at time s must be immediately scrapped, if this has not already happened, and hence:

$$PV(s, T) = 0 \tag{9}$$

Starting from (9), we can work backwards to determine the entire sequence of preceding present values.

The net present value of a new plant can be calculated from (7).

Example

The discussion in the text is based on the following example. It is assumed that condition (1) holds so that production in a continuing plant is always at the level $Y(t)$ that is given by exogenous demand. However, a plant will be prematurely scrapped as soon as its present value is no longer positive. Output per plant is initially Y_2 . At the start of the recession, there is a sharp fall in demand, which is followed by a stepped recovery. Output per plant initially falls to Y_0 at time 0 and then remains constant until time R_1 , when it rises to Y_1 . Output per plant continues at this new level until time R_2 , when there is a further increase to Y_2 . Thus,

$$Y(t) = \begin{cases} Y_0 & \text{for } 0 \leq t < R_1 \\ Y_1 & \text{for } R_1 \leq t < R_2 \\ Y_2 & \text{for } t < 0 \text{ and } R_2 \leq t \end{cases} \quad (10)$$

where $Y_0 < Y_1 < Y_2$.

It is assumed that $R_2 < T$. The latter condition ensures that no new plant set up during the recession will reach the end of its physical life before recovery is complete. The assumptions about output imply that employment per plant is as follows:

$$L(t) = \begin{cases} F + bY_0 & \text{for } 0 \leq t < R_1 \\ F + bY_1 & \text{for } R_1 \leq t < R_2 \\ F + bY_2 & \text{for } t < 0 \text{ and } R_2 \leq t \end{cases} \quad (11)$$

Labour productivity follows the following stepped trajectory:

$$p(t) = \begin{cases} p_0 = \frac{Y_0}{F + bY_0} & \text{for } 0 \leq t < R_1 \\ p_1 = \frac{Y_1}{F + bY_1} & \text{for } R_1 \leq t < R_2 \\ p_2 = \frac{Y_2}{F + bY_2} & \text{for } t \leq 0 \text{ and } R_2 \leq t \end{cases} \quad (12)$$

Since $Y_0 < Y_1 < Y_2$ it follows that $p_0 < p_1 < p_2$. Thus, labour productivity initially falls sharply, but then increases during the course of time. This is because a fixed amount of overhead labour F is spread over more units of output as recovery proceeds.

Wages and short-term interest rates follow stepped trajectories with time profiles:

$$w(t) = \begin{cases} w_0 & \text{for } 0 \leq t < R_1 \\ w_1 & \text{for } R_1 \leq t < R_2 \\ w_2 & \text{for } R_2 \leq t \end{cases} \quad (13)$$

$$r(t) = \begin{cases} r_0 & \text{for } 0 \leq t < R_1 \\ r_1 & \text{for } R_1 \leq t < R_2 \\ r_2 & \text{for } R_2 \leq t \end{cases} \quad (14)$$

We make no assumption about wages and interest rates before the recession.

Parameter values

The base projection used in the text assumes the following parameter values:

$$\begin{aligned} T &= 33, K = 71, F = 70, b = 0.63, \\ Y_0 &= 90, Y_1 = 95, Y_2 = 100, \\ R_1 &= 1.5, R_2 = 6.0, \\ w_0 &= w_1 = w_2 = 0.723, \\ r_0 &= r_1 = r_2 = 0.03. \end{aligned} \quad (15)$$

Present values were calculated using the time interval $\Delta t = 0.1$.

Simulations were also done using different parameter values and different time profiles for demand. The results were similar to those reported in the text.

A model of labour hoarding

The following model is designed to illustrate the impact of changes in certain parameters or variables, such as exogenously given wage rates, on the hoarding of labour that is not currently required for production.

Immediately before the recession begins, there are n plants that are all of age 0 and identical from a technical point of view. All have the same physical lifespan T . Aggregate output in the economy is exogenously determined by demand and is shared out equally amongst all plants. Parameter values are such that it is always profitable to produce at the maximum saleable level.

As in the model example above, there is a sharp recession followed by a two-step recovery. Output per plant is initially Y_2 . At the start of the recession, there is a discontinuous fall in demand followed by a stepped recovery. Output per plant falls to Y_0 at time 0 and then remains constant until time R_1 , when it rises to Y_1 . Output per plant continues at this new level until time R_2 , when there is a further increase to Y_2 . Thus:

$$Y(t) = \begin{cases} Y_0 & \text{for } 0 \leq t < R_1 \\ Y_1 & \text{for } R_1 \leq t < R_2 \\ Y_2 & \text{for } t < 0 \text{ and } R_2 \leq t \end{cases} \quad (16)$$

where $Y_0 < Y_1 < Y_2$. It is assumed that $R_2 < T$.

The labour that is strictly required for production is as follows:

$$\begin{aligned}
L_0 &= F + bY_0 \quad \text{for } 0 \leq t < R_1 \\
L_1 &= F + bY_1 \quad \text{for } R_1 \leq t < R_2 \\
L_2 &= F + bY_2 \quad \text{for } t < 0 \text{ and } R_2 \leq t
\end{aligned} \tag{17}$$

Wage and interest rates are exogenous and follow the paths shown in (13) and (14) above.

Hiring and firing costs

Labour may be costly to hire or fire. Let h and f denote, respectively, the cost of hiring or firing a worker. Such costs may influence employment decisions. Table B1 specifies three distinct employment trajectories.

Table B1: Employment trajectories

	$t < 0$	$0 \leq t < R_1$	$R_1 \leq t < R_2$	$R_2 \leq t$
No hoarding	L_2	L_0	L_1	L_2
Partial hoarding	L_2	L_1	L_1	L_2
Full hoarding	L_2	L_2	L_2	L_2

In the no hoarding case, only the labour that is strictly required for production is kept on. In the partial hoarding case, some excess labour is kept on in the first period until output partially recovers. In the full hoarding case, the entire labour force is kept on until recovery is complete.

Other employment trajectories are feasible but parameter values are such that they are dominated by one of the trajectories shown in table B1.

Define the following present values:

No hoarding:

$$\begin{aligned}
PV_{01} &= \int_0^{R_1} D(0,t)(Y_0 - w_0 L_0) dt + \int_{R_1}^{R_2} D(0,t)(Y_1 - w_1 L_1) dt \\
&\quad + \int_{R_2}^T D(0,t)(Y_2 - w_2 L_2) dt \\
&\quad - (L_2 - L_0)f - D(0, R_1)(L_1 - L_0)h - D(0, R_2)(L_2 - L_1)h
\end{aligned} \tag{18}$$

Partial hoarding:

$$\begin{aligned}
PV_{11} &= \int_0^{R_1} D(0,t)(Y_0 - w_0 L_1) dt + \int_{R_1}^{R_2} D(0,t)(Y_1 - w_1 L_1) dt \\
&\quad + \int_{R_2}^T D(0,t)(Y_2 - w_2 L_2) dt \\
&\quad - (L_2 - L_1)f - D(0, R_2)(L_2 - L_1)h
\end{aligned} \tag{19}$$

Full hoarding:

$$PV_{22} = \int_0^{R_1} D(0,t)(Y_0 - w_0 L_2)dt + \int_{R_1}^{R_2} D(0,t)(Y_1 - w_1 L_2)dt + \int_{R_2}^T D(0,t)(Y_2 - w_2 L_2)dt \quad (20)$$

In the partial and no hoarding cases, the present value consists of the discounted future profit stream minus immediate firing costs minus discounted future hiring costs. In the full hoarding case, there are no hiring or firing costs.

Parameter values are chosen such that $\max(PV_{01}, PV_{11}, PV_{22}) > 0$. This ensures that the plant will be kept open. The optimal employment trajectory is chosen by comparing the present values shown in (18) to (20) and choosing the one with the highest present value.

Example

The example in the text assumes that there are two types of firm, which are present in equal number. Firing costs of each type of firm are zero, but hiring costs differ. Firms of the first type have $h = 1.350$, $f = 0$ and firms of the second type have $h = 1.994$, $f = 0$.

The remaining parameter base case values are as follows:

$$T = 100; F = 50; b = 2.7; Y_0 = 90; Y_1 = 95; Y_2 = 100; R_1 = 5; R_2 = 7;$$

$$w_0 = 0.3; w_1 = 0.3; w_2 = 0.3; r_0 = 0; r_1 = 0; r_2 = 0.03.$$

Appendix C: Characteristics of low and high productivity sectors

Tests of the importance of such influences as firing and hiring costs and low wages can be carried out at a disaggregated level focussed on individual sectors or firms. Such an approach is reportedly being pursued at the Bank of England.¹⁸³ But there are significant difficulties to be faced. Broad macroeconomic tendencies of interest may be easily obscured by the circumstances facing individual businesses. Moreover, the quality of output and jobs data, the latter insecurely based on the pattern revealed by Workforce Jobs, is likely to deteriorate significantly the finer the level of detail.¹⁸⁴

As an alternative, this study draws a distinction at an aggregate level between relatively low and relatively high labour productivity activities, largely in the private sector. Vital statistics of the two sectors are shown in Table C1. The employment data are based on Workforce Jobs but scaled to align with the Labour Force Survey.¹⁸⁵

The low-productivity sector accounts for roughly half the jobs of the two sectors combined, but only a third of combined value added (workers' compensation plus operating surplus). The level of employment in relation to value added in the low-productivity sector is more than twice that in the high-productivity sector.

The main activities classified as low-productivity are services, such as wholesale and retail distribution, accounting for half the value added of the low-productivity sector, and general support, mainly business, services, like employment placement agencies, cleaning services and call centres; together these account for 20% of the sector's value added. A little more than 10% is accounted for by hotels and catering services. Arts, recreation and various personal services account for most of the remainder.

¹⁸³ Tucker (2011).

¹⁸⁴ O'Mahony and Timmer (2009) also note "... the reliability of the data is likely to be lower the finer the industrial detail ...". Disaggregated figures are especially prone to sector misclassifications. Haskel et al. (2011), for example, note discrepancies due to the treatment of agency workers, leading to contrasting estimates of jobs and productivity growth in both finance and business services. Large and time-varying differences in the Local Unit and Reporting Unit based Workforce Jobs data (see below) give rise to general concern about the reliability of the ONS figures used to apportion LFS employment data at the disaggregated industrial level. Recent WFJ data are also subject to considerable revision.

¹⁸⁵ The Workforce Jobs series used is similar to the one regularly published in ONS *Labour Market Statistics* save for the industrial classification of employees. The published series shows the number of employees derived from the payroll returns of individual workplaces ("Local Units") rather than, as used here, from the head offices of businesses ("Reporting Units"). The principal product, and hence industrial classification, of a Reporting Unit may differ from the principal product of Local Units, especially those that comprise the workplaces of multi-product enterprises. Contrasting methods of benchmarking quarterly data to the annual Business Register Employment Survey give rise to slight differences between the Reporting Unit and Local Unit WFJ employee series at the economy level. We are indebted to John Appleton and Steffan Hess of ONS for expert advice and the provision of Reporting Unit data in seasonally unadjusted form. For sectors other than public administration, education and health (Standard Industrial Classification sections O to Q), we use the standard ONS method (X-12-ARIMA) to adjust the Reporting Unit employee data for seasonality, with the economy total constrained to the sum of parts. For sections O to Q, we use as appropriate the ONS seasonal factors for the LU WFJ series, which are similar to the RU WFJ series.

The activities classified as high-productivity split roughly 45:55 between producers of goods and producers of services. Manufacturing accounts for 20% of the value added of the high productivity sector; mining, utilities and construction account for a further 25%. The largest of the services sectors included in this category are finance (nearly 20% of the whole) and professional business services (15%). Transport, information and communication services account for the remainder.

The low and high labour productivity sectors are distinguished by other broad characteristics – capital intensity, skill intensity and innovation intensity.

Capital intensity: the ratio of capital to labour employed is relatively low in the low-productivity sector: it employs half the labour of the two sectors combined but only 40% of the largely tangible capital stock. Consistent with the higher share of wages in value added, the sector's relatively low capital intensity would probably be more marked were allowance made for sectors' use of other forms of intangible capital. Jonathan Haskel and others calculate that the ratio of investment in intangibles, such as scientific knowledge, brand image and reputation, to investment in tangible capital, like machinery and structures, is especially high in manufacturing, finance and business services.¹⁸⁶ On those authors' calculations, which pre-date the change in industrial classification and large statistical revisions, the growth of intangible investment made notable contributions to pre-crisis output growth in manufacturing and business services but also in retailing, part of the low-productivity sector.

Skill intensity: the proportion of workers with high skills is relatively low in the low-productivity sector, consistent with the much lower level of average pay per worker. The high proportion (in excess of 30%) of generally low paid part-time workers employed in the sector explains part of the pay differential, but the average pay even of full-time employees is about 30% below the high-productivity sector average. In the low-productivity sector, more than 10% of the total remuneration of employees goes to those with no formal qualification; in the high-productivity sector the comparable share is well below 10%.¹⁸⁷ This difference is mirrored by the share of remuneration received by those with a university degree.

Innovation intensity: Before the business cycle peak, labour productivity growth in the low-productivity sector trailed productivity growth in the high-productivity sector by 1 percentage point a year (1¼ percentage points excluding the impact of declining North Sea oil and gas extraction), despite similar rates of output growth. Although measurement problems make exact attribution impossible,¹⁸⁸ it is probable that differences in the rate of innovation are partly responsible. Based on the contribution of intangible capital and underlying productivity, Haskel and others identify manufacturing, finance and business services as the most innovative sectors.¹⁸⁹

¹⁸⁶ Haskel et al. (2011).

¹⁸⁷ Tentative estimate using EU KLEMS data for 2005 (Timmer et al. (2007). The acronym refers to the decomposition of inputs: capital ("K"), labour, energy, materials and services.

¹⁸⁸ Decompositions of productivity growth available at the time of writing do not incorporate the major official revisions to historic output growth or the new 2007 Standard Industrial Classification.

¹⁸⁹ Haskel et al. (2011).

As far as can be told from movements in real consumption wages, real pay levels have fallen considerably in both the low and high productivity sectors. By the beginning of 2012, the real wage shortfall against the previous trend was over 14% in the low-productivity sector and 18% in the high-productivity sector, as Table C2 records.¹⁹⁰

Table C1: Vital statistics – relatively low and high labour productivity sectors

Sector characteristics 2008 values, unless stated	- Labour productivity -	
	Low	High
Share, %, of sum-of-sectors:		
Value added	31	69
Jobs	50	50
Net capital stock*	40	60
Sector relative to sum-of-sectors (sum = 1):		
Ratio of number of jobs to value added	1.6	0.7
Mean gross weekly pay (year to April 2008)**	0.7	1.2
Each sector's:		
Employees' compensation, % of value added	66	57
Part-time employees, % of all employees	36	11
Pre-peak growth, % p.a.		
Output	3.0	2.7
Output per job	1.8	2.8

Sources and notes: ONS Labour Market Statistics, National Accounts, Productivity Statistics, Supply and Use Tables and Annual Survey of Hours and Earnings (ASHE), authors' calculations. Relatively high (low) labour productivity sectors are those with 2008 ratios of gross value added to labour employed above (below) the average for these sectors taken together. Details of sector composition are given in the text. Pre-peak growth rates refer to the seven-year period ending 1Q 2008. * Roughly inferred from 2010 Blue Book, 2003 Standard Industrial Classification, data. ** Derived from ASHE, the officially preferred source for mean gross pay levels. In the case of the low productivity sector, estimated mean pay is over 10% in excess of the comparable figure derived from the official measure of average weekly earnings. The estimates for the high productivity sector are similar.

Table C2: Real wage growth and gap

Annual average growth, %, unless stated	Before cycle peak	Since peak to 1Q 2012	Gap (%) 1Q 2012
Whole economy consumption wage	2.3	-2.2	-16.6
Of which:			
Low productivity sector	2.1	-1.8	-14.4
High productivity sector	2.9	-2.1	-18.2

Sources and notes: ONS, authors' calculations. "Before cycle peak": seven years ending 1Q 2008; "Since peak to 1Q 2012": period from 1Q 2008. "Gap" – difference between level and extrapolated pre-cycle peak trend, as per cent of trend. Consumption wage: nominal average weekly earnings (including bonuses), reconstructed using official weights, relative to consumer price index.

¹⁹⁰ Widening pay differentials may also be of relevance in view of the high proportion of generally low paid part-timers on the payrolls of low-productivity sector firms. Since 2007, the earnings of the lowest paid part-time employees have fallen even in nominal terms. Gross weekly earnings of part-time employees in the lowest decile fell 1½% between 2007 and 2011; those in the highest decile rose 12%. (Source: Annual Survey of Hours and Earnings, November 2011.)

Appendix D: Decomposition of the national productivity gap¹⁹¹

Consider the aggregate level of productivity in a three-sector economy:

$$Z \equiv \frac{O}{J} \equiv \frac{O_a + O_b + O_c}{J_a + J_b + J_c} \quad (1)$$

where Z , O , J denote the levels of productivity, output¹⁹² and employed labour (jobs) respectively, and the subscripts denote the three sectors: a , b , c .

The aggregate level of productivity can be re-expressed as the sum of labour-share weighted sectoral productivity levels:

$$Z \equiv \beta_a Z_a + \beta_b Z_b + \beta_c Z_c \quad (2)$$

where, for example, $\beta_a \equiv \frac{J_a}{J}$ and $Z_a \equiv \frac{O_a}{J_a}$.

In terms of trend levels, denoted by a superscript accent, the aggregate productivity level equivalent to identity (1) is defined by:

$$Z' \equiv \frac{O'}{J'} \quad (3)$$

The economy-wide productivity gap, θ , is defined as:

$$\theta \equiv \frac{Z}{Z'} - 1 \quad (4)$$

which can be re-expressed using identities (2) and (3) as:

$$\theta \equiv \frac{Z_a}{Z'_a} \left(\frac{Z'_a}{Z'} \beta_a \right) + \frac{Z_b}{Z'_b} \left(\frac{Z'_b}{Z'} \beta_b \right) + \frac{Z_c}{Z'_c} \left(\frac{Z'_c}{Z'} \beta_c \right) - 1 \quad (5)$$

The elements on the right-hand side of identity (5) comprise for each sector the product of the ratio of actual productivity to its trend level and an implicit weight.

For example, in the case of sector a :

$$\frac{Z_a}{Z'_a} \equiv 1 + \theta_a \quad (6)$$

with an implicit weight given by:

¹⁹¹ This is an abbreviated version of the appendix in Martin (2011a).

¹⁹² This expression is applicable only to UK chain-linked GDP estimates from the reference year forward, when the components are additive. The implicit output residual error is assumed to be zero.

$$\frac{Z'_a}{Z'} \beta_a \equiv \frac{\left(\frac{O'_a}{J'_a}\right)}{\left(\frac{O'}{J'}\right)} \beta_a \equiv \frac{\left(\frac{O'_a}{O'}\right)}{\left(\frac{J'_a}{J'}\right)} \beta_a \equiv \frac{\alpha'_a}{\beta'_a} \beta_a \quad (7)$$

where α'_a denotes sector a 's trend output share.

Using $\sum_{i=a}^{i=c} \alpha'_i = 1$, $\frac{\beta_i}{\beta'_i} \equiv 1 + \frac{\beta_i - \beta'_i}{\beta'_i}$ and, as shown in expression (7), $\frac{Z'_a}{Z'} \equiv \frac{\alpha'_a}{\beta'_a}$, identity (5) can be re-written after some manipulation as:

$$\theta \equiv \sum_{i=a}^{i=c} \alpha'_i \theta_i + \sum_{i=a}^{i=c} \left((\beta_i - \beta'_i) \frac{Z'_i}{Z'} \right) + \sum_{i=a}^{i=c} \left(\frac{\beta_i - \beta'_i}{\beta'_i} \alpha'_i \theta_i \right) \quad (8)$$

Each sector's contribution to the national productivity gap comprises three parts: a direct output share component – the product of the sector's productivity gap and its trend output share; an indirect employment share shift component – the product of the sector's relative trend productivity and the difference between the sector's actual and trend share of national employment; and a mixed component, which reflects the sector's productivity gap, its output share and the employment share shift.

An alternative formulation stresses the use of employment weights:

$$\theta \equiv \sum_{i=a}^{i=c} \beta_i \theta_i + \sum_{i=a}^{i=c} \beta_i \left(\frac{Z'_i}{Z'} - 1 \right) + \sum_{i=a}^{i=c} \beta_i \theta_i \left(\frac{Z'_i}{Z'} - 1 \right) \quad (9)$$

This identity expresses the economy-wide productivity gap in terms of the employment weighted sectoral productivity gaps and ratios.

At the sector level, there are significant differences between the second terms in identities (8) and (9). The second term in identity (8) is negative for all employment-losing sectors and positive for all employment-gaining sectors, relative to trend, irrespective of the level of sectoral productivity relative to the national average. The second term in identity (9), by contrast, is negative for all below-average productivity sectors and positive for all above-average productivity sectors, irrespective of whether the sectors are gaining or losing employment share.

However, the economy-wide summation of these two terms is the same. Noting that

$\sum_{i=a}^{i=c} \alpha'_i = \sum_{i=a}^{i=c} \beta_i = 1$, the following is true:

$$\sum_{i=a}^{i=c} \left((\beta_i - \beta'_i) \frac{Z'_i}{Z'} \right) \equiv \sum_{i=a}^{i=c} \left(\beta_i \frac{Z'_i}{Z'} - \beta'_i \frac{\alpha'_i}{\beta'_i} \right) \equiv \sum_{i=a}^{i=c} \beta_i \left(\frac{Z'_i}{Z'} - 1 \right) \quad (10)$$

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