Office for National Statistics

Economic & Labour Market Review

Contents

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The Office for National Statistics (ONS) is the executive office of the UK Statistics Authority, a non-ministerial department which reports directly to Parliament. ONS is the UK government's single largest statistical producer. It compiles information about the UK's society and economy, and provides the evidence-base for policy and decision-making, the allocation of resources, and public accountability. The Director-General of the ONS reports directly to the National Statistician who is the Authority's Chief Executive and Head of the Government Statistical Service.

The Government Statistical Service

The Government Statistical Service (GSS) is a network of professional statisticians and their staff operating both within the Office for National Statistics and across more than 30 other government departments and agencies.

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Contacts

This publication

For information about this publication, contact the editorial team, email: elmr@ons.gsi.gov.uk

Other customer enquiries

ONS Customer Contact Centre
Tel: 0845 601 3034
International: +44 (0)845 601 3034
Minicom: 01633 815044
Email: info@statistics.gsi.gov.uk
Fax: 01633 652747
Post: Room 1015, Government Buildings,
Cardiff Road, Newport, South Wales NP10 8XG

www.ons.gov.uk

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Media enquiries

Tel: 0845 604 1858
Email: press.office@ons.gsi.gov.uk

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In brief

Measuring business growth

A small minority of high-growth businesses hold the key to job creation and wider prosperity. This is the main finding from new research 'Measuring Business Growth' published by the National Endowment for Science Technology and the Arts (NESTA), based on analysis undertaken in the Virtual Microdata Laboratory (VML) at ONS. It shows that 6 per cent of UK businesses with the highest growth rates generated half of new jobs created by existing businesses between 2002 and 2008. Although these companies came from across the country and from all sectors of the economy, the research shows that their innovation was a source of growth.

Further research 'Business Growth and Innovation', also based on datasets held within the VML, considers the wider benefits of growth businesses. The report continues to suggest how these findings are important for economic policy – which should focus on promoting innovation and on the small number of companies with high growth potential; rather than more broadly-based business support programmes for new start ups and small and medium enterprises. More importantly it shows that an approach of backing excellence and innovation is not elitist but the best way of generating employment.

More information

Anyadike-Danes M, Bonner K, Hart M and Mason C (2009): 'Measuring Business Growth', NESTA

Mason G, Bishop K and Robinson C (2009): 'Business growth and innovation', NESTA

Both papers available at www.nesta.org.uk

Contact

webmaster@nesta.org.uk

Stephen Penneck appointed as Director General for ONS

The Prime Minister has approved the appointment of Stephen Penneck as the new Director General for ONS, who will take up the position on promotion from his current post in ONS as Director of Methodology.

Changes put in place this September, following the appointment of Jil Matheson as National Statistician, mean that day-to-day management responsibilities for ONS will rest with the Director General. The role of the National Statistician is now focused on overseeing the Government Statistical Service (GSS) and official statistics as a whole. The new Director General will report to both the National Statistician and on ONS matters to the UK Statistics Authority through the ONS Board.

More information

www.ons.gov.uk
www.statisticsauthority.gov.uk

Contact

DGPrivateOffice@ons.gov.uk

Median weekly pay for full-time employees grew by 2 per cent in the year to April 2009

The results of the Annual Survey for Hours and Earnings (ASHE), published by ONS on 12 November 2009, show that the median weekly pay for full-time employees in the UK grew by 2.0 per cent in the year to April 2009, to reach £489. Median earnings of full-time male employees were £531 per week in April 2009; for women the median was £426.

10 per cent of full-time employees earned more than £971 per week, while 10 per cent earned less than £271. Between April 2008 and April 2009 the distribution of gross weekly pay narrowed with a 3.2 per cent increase at the bottom decile, and a 2.1 per cent increase at the top decile.

Median gross weekly earnings for full-time employees were highest for 40-49 year olds at £551. Male employees reached their highest earnings in this age group at £606, whereas female employees reached their highest earnings for 30-39 year olds at £498. Earnings increased until employees reached these age groups and steadily decreased thereafter.

Median full-time weekly earnings in London were £627, significantly higher than in other regions, where they ranged from £436 in the North East to £514 in the South East.

The full-time occupations with the highest earnings in 2009 were 'health professionals', (median pay of full-time employees of £1,031 per week), followed by 'corporate managers' (£745) and 'science and technology professionals' (698). The lowest paid of all full-time employees were those in 'sales occupations', at £278 per week.

The percentage difference between the median level of full-time earnings in the public sector (£539 per week) and the private sector (£465 per week) widened over the year to April, following annual increases of 3.1 per cent and 1.0 per cent respectively.

More information

The full results of ASHE can be found at: www.statistics.gov.uk/StatBase/Product.asp?vlnk=15313

Contact

earnings@ons.gov.uk

Reducing personal greenhouse gas emissions – how our lifestyles give rise to climate change

The world's leaders are gathering in Copenhagen to agree new international targets to reduce greenhouse gas emissions. These have to ultimately translate into changes in the amount of greenhouse gas used by households and in the manufacture of goods and services. The book 'The Economical Environmentalist' uses information from the Office for National

Statistics' *Environmental Accounts* and studies published by DEFRA (Department for Environment, Food and Rural Affairs) and DECC (Department for Energy and Climate Change) to allocate emissions to day to day activities and purchases and discuss opportunities for reductions for different households.

Emissions of the six major greenhouse gases were equivalent to 29.3 tonnes of carbon dioxide (tCO_2e) per household ($12.2tCO_2e$/person) in 2004. About 30 per cent of this was from food consumption, 17 per cent from leisure and 15 per cent from fossil fuel heating. The emissions per household are highly skewed according by income. In 2007 emissions from home energy use and travel by the highest earning decile of households was $16tCO_2$, that from the lowest just $4tCO_2$ – about the same as the highest earning decile's emissions from flying.

There is abundant scope for reducing our emissions by small changes in our purchases: for instance avoiding food that has been air freighted, grown in heated greenhouses or which is produced from cattle or sheep. The author, Prashant Vaze, who led ONS's Environmental Accounts branch between 1995 and 1998, identified emission cuts of 34 per cent from modest and often cost effective changes in his purchases or improvements to his home's building fabric.

More information

www.economicalenvironmentalist.co.uk
www.statistics.gov.uk/STATBASE/Product.asp?vlnk=3698

Contact

To contact the author visit
www.economicalenvironmentalist.co.uk

UKCeMGA and NIESR international conference on public sector measurement

ONS UK Centre for the Measurement of Government Activity (UKCeMGA) and the National Institute of Economic and Social Research (NIESR) held an international conference from 11-13 November 2009 discussing these and other issues, from both the UK and international experience:

- How do we measure the quality of public services?
- What are the implications of quality metrics for policy-makers?
- What is the output of a collective service such as defence or fire?

Key speakers included Joe Grice (ONS), Paul Schreyer (OECD), Martin Weale (NIESR), Erwin Diewert (University of British Columbia) and Jack Triplett (Brookings Institute, Washington). The conference programme and links to the presented papers can be found at the UKCeMGA website (see more information).

More information

www.ons.gov.uk/about-statistics/ukcemga/index.html

Contact

ukcemga@ons.gsi.gov.uk

Social Trends: the drawing of a new era

On 4 December 2009 ONS published the Labour Market chapter of Social Trends, one of four chapters released on this day. This uses data from the Labour Force Survey to show the trends in employment rates of men and women between 1971 and 2009 and the links between the labour market and the economic cycle over this period.

The main finding is that there was a convergence of employment rates for men and women, which largely took place in the 1970s and 1980s, and that in the 1990s the trend towards convergence slowed. Male and female employment rates both increased in the periods of growth between the recessions of the early 1980s and early 1990s. However, the recession of the early 1990s caused the employment rate to fall more for men than it did for women. And this pattern seems to be occurring again during the recession that began in 2008. Between Q2 2008 and Q2 2009 employment rates for men fell from 79 per cent to 76 per cent, while for women the rate fell from 70 per cent to 69 per cent.

The chapter also provides data on the changes in employee jobs by industry over the period 1978 to 2009. In 1978 the manufacturing sector accounted for the highest proportion of jobs at 28.5 per cent. This proportion has fallen steadily over the last 30 years to reach 10.0 per cent in 2009, the lowest proportion since records began and representing an overall fall of around two-thirds since 1978. Conversely, the finance and business services sector has shown an increase of around 10 percentage points over the same period from 10.5 per cent in 1978 to 20.8 per cent in 2009. This sector however, has fallen slightly from 21.4 per cent in 2008.

These four recently published chapters are the first wave of releases that will build up to Social Trends 40. A further two chapters of Social Trends will be published online only on 16 February 2010, and two more on 8 April 2010. On 23 June 2010 the remaining five chapters, together with the initial eight chapters will be published directly on the ONS website to form the 40th edition of Social Trends. This edition will also be available as a printed publication from Palgrave Macmillan, and will be the final printed edition of Social Trends. The theme for this edition of Social Trends is 'Forty years of social trends in the UK'.

More information

www.statistics.gov.uk/socialtrends/
www.statistics.gov.uk/notices/ST40-4-dec-09.asp

Contact

01633 455931
social.trends@ons.gov.uk

Emigration reaches record high in 2008

The number of people leaving the UK for 12 months or more reached a record high in 2008, with an estimated 427,000 people emigrating. This was up from 341,000 in 2007 and 398,000 in 2006. This rise was as a result of a 50 per cent increase in non-British citizens emigrating from 169,000 in 2007 to 255,000 in 2008. Just over half of the 86,000 increase were citizens of the A8 Accession countries which joined the EU in 2004. These figures were published on by ONS in the *Migration Statistics 2008* annual report on 26 November 2009.

An estimated 590,000 people arrived to live in the UK in 2008, the second highest figure on record after 596,000 in

2006. This compared with 574,000 in 2007 and represents a continuation of the level of immigration seen since 2004. Of all immigrants 505,000 (86 per cent) were non-British citizens in 2008.

Net migration, the difference between immigration and emigration, decreased from 233,000 in 2007 to 163,000 as a result of increased emigration.

There has been a large increase in the number of people emigrating for work related reasons, particularly those with a definite job to go to. In 2008 an estimated 136,000 people emigrated from the UK to take up a definite job, compared with 100,000 in 2007.

The International Passenger Survey (IPS) is the main component of these Long-Term International Migration estimates. IPS estimates allow a more detailed analysis of the characteristics of international migrants. This reveals that the increase in emigration of non-British citizens was most notable in the 25 to 44 age group, consistent with higher numbers of people emigrating for work related reasons. The IPS shows an increase in the number of non-British citizens leaving the UK to take up a definite job – up from 45,000 in 2007 to 62,000 in 2008. IPS estimates also show that Poland was the most popular country of next residence for non-British emigrants in 2008, with 50,000 people migrating there.

More information

www.statistics.gov.uk/StatBase/Product.asp?vlnk=507

Contact

migstatsunit@ons.gov.uk

Business demography 2008: births and deaths decrease between 2007 and 2008

New figures published by ONS on 30 November 2009 show that in 2008 there were 270,000 business 'births' in the UK, a rate of 11.6 per cent. This was compared with 281,000 births in 2007, a rate of 12.3 per cent. In 2008 there was a 3.7 per cent decrease in the number of business births.

There were 219,000 business 'deaths' in 2008, a rate of 9.4 per cent. This compares with 223,000 business deaths in 2007 and a rate of 9.8 per cent. This gives a decrease in business deaths between 2007 and 2008 of 1.8 per cent.

The highest rate of births occurred in business administration and support services with a rate of 16.2 per cent. The highest number of births, however, occurred in professional; scientific and technical, with over 54,000 new businesses. The highest number of business deaths occurred in construction, with 33,000, followed by professional; scientific and technical, with over 32,000. The highest business death rate occurred in accommodation and food services with a death rate of 13.1 per cent.

Within the regions London had the highest business birth and death rates at 15.0 per cent and 10.3 per cent respectively. Northern Ireland had the lowest birth and death rates at 9.5 per cent and 7.3 per cent respectively.

More information

www.statistics.gov.uk/StatBase/Product.asp?vlnk=15186

Contact

andrew.allen@ons.gov.uk

Gender pay gap narrows

The gender pay gap (as measured by the median hourly pay excluding overtime) narrowed between 2008 and 2009. For full-time employees, the pay gap is 12.2 per cent, down from 12.6 per cent in 2008. For part-time employees, the gap is -2.0 per cent, compared with -3.7 per cent in 2008. The gender pay gap for all employees has decreased to 22.0 per cent from 22.5 per cent in 2008. In April 2009 hourly rates for men were £12.97 for full-timers, £7.71 for part-timers and £12.42 for all employees. For women, hourly rates were £11.39 for full-timers, £7.86 for part-timers and £9.68 for all employees.

When calculated using the mean rather than the median, women's hourly pay was 16.4 per cent less than men's pay for full-time employees, 13.2 per cent less than men's pay for part-time employees and 20.2 per cent less for all employees. The mean pay gaps for full-time, part-time and all employees in 2008 were 17.4 per cent, 15.2 per cent and 21.3 per cent respectively.

Based on full-time hourly earnings excluding overtime, women's earnings increased more slowly across the bottom 10 per cent of the distribution than men's, with a growth of 3.9 per cent compared with 4.0 per cent for their male counterparts. The hourly earnings of the top ten per cent grew by 2.9 per cent and 4.7 per cent for men and women respectively.

The scale and direction of the gender pay gap varies according to age. For instance, full-time 16-17 year-old females earned 12.6 per cent more per hour than males, but part-time females earned 1.3 per cent less than males. The largest pay gaps for full-time, part-time and all employees are in the 40-49 age-group at 18.4 per cent, 23.7 per cent and 29.5 per cent respectively.

The gender pay gap in the public sector was 11.6 per cent for full-timers, 18.3 per cent for part-timers and 21.0 per cent for all employees. In the private sector, the pay gap was 20.8 per cent for full-timers, 0.4 per cent for part-timers and 28.8 per cent for all employees.

The widest pay gaps by occupation are seen in the Skilled Trades where the gap ranges from 22.7 per cent to 31.2 per cent. The narrowest pay gaps for full-time and all employees are in Professional occupations.

These results were taken from the Annual Survey of Hours and Earnings (ASHE) published by ONS on 12 November 2009. Although median hourly pay provides a useful comparison between the earnings of men and women, it does not necessarily indicate differences in rates of pay for comparable jobs. Pay medians are affected by the different work patterns of men and women, such as the proportions in different occupations, their length of time in jobs and whether they work full-time or part-time.

A paper outlining the findings of a review into how the differences between men's and women's pay should be presented in ONS statistical bulletins was published on the ONS website on 4 November 2009 (see Hicks and Thomas, 2009). This concludes that these differences in pay are best presented using median earnings, although differences in mean earnings will also continue to be provided. However, given the complexity of the labour there is a need to present a number of measures to reflect these differences.

More information

www.statistics.gov.uk/StatBase/Product.asp?vlnk=13101

Hicks S and Thomas J (2009) 'Presentation of the gender pay gap: ONS position paper', available at www.statistics.gov.uk/cci/article.asp?ID=2303

Contact

earnings@ons.gov.uk

242,000 jobs below the national minimum wage in United Kingdom

Low pay estimates taken from the 2009 Annual Survey of Hours and Earnings (ASHE), show that the number of jobs paid below the national minimum wage in the UK was 242,000 in April 2009, amounting to 0.9 per cent of all jobs in the labour market.

In April 2009 there were three rates for the national minimum wage: one for those aged between 16 and 17 (£3.53 per hour), one for those aged between 18 and 21 (£4.77 per hour) and one for those aged 22 and over (£5.73 per hour).

The number of jobs paid below the national minimum wage were:

- 14,000 jobs (4.1 per cent) held by those aged 16 to 17,
- 44,000 jobs (2.6 per cent) held by those aged 18 to 21, and
- 184,000 jobs (0.8 per cent) held by those aged 22 and over

People in part-time work were more than twice as likely as people in full-time work to be paid less than minimum wage, with 1.5 per cent of part-time jobs and 0.7 per cent of full-time jobs falling below the minimum wage.

Jobs held by women were more likely to fall below the minimum wage than jobs held by men (1.1 per cent compared with 0.8 per cent). This was due to the greater number of women in part-time jobs.

It is important to note that these estimates do not measure non-compliance with the national minimum wage legislation. The survey used to provide these estimates does not indicate whether individuals fall into a category that is exempt from the legislation, such as apprentices or new trainees.

More information

www.statistics.gov.uk/StatBase/Product.asp?vlnk=5837

Contact

earnings@ons.gov.uk

UPDATES

Updates to statistics on www.statistics.gov.uk

5 November

Index of production

0.8% quarterly fall in production output
www.statistics.gov.uk/cci/nugget.asp?id=198

6 November

Producer prices

Factory gate inflation rises 1.7%
www.statistics.gov.uk/cci/nugget.asp?id=248

10 November

UK Trade

Deficit widened to £3.5 billion in September
www.statistics.gov.uk/cci/nugget.asp?id=199

11 November

Average earnings

Average pay slows in year to September 2009
www.statistics.gov.uk/cci/nugget.asp?id=10

Employment

Rate falls to 72.5%
www.statistics.gov.uk/cci/nugget.asp?id=12

12 November

Low pay jobs

242,000 jobs below national minimum wage in the United Kingdom
www.statistics.gov.uk/cci/nugget.asp?id=224

Earnings

2009 Annual Survey of Hours and Earnings (ASHE)
www.statistics.gov.uk/cci/nugget.asp?id=285

17 November

Inflation

CPI inflation 1.5%, RPI inflation -0.8%
www.statistics.gov.uk/cci/nugget.asp?id=19

19 November

Travel and tourism

Visits abroad continue to fall
www.statistics.gov.uk/cci/nugget.asp?id=352

Public sector

October: £7.7 billion current budget deficit
www.statistics.gov.uk/cci/nugget.asp?id=206

Retail sales

October shows annual growth of 3.4%
www.statistics.gov.uk/cci/nugget.asp?id=256

24 November

Business investment

3.0% down in third quarter 2009
www.statistics.gov.uk/cci/nugget.asp?id=258

25 November

Index of services

0.1% three-monthly fall into September
www.statistics.gov.uk/cci/nugget.asp?id=558

GDP growth

Economy contracts by 0.3% in Q3 2009
www.statistics.gov.uk/cci/nugget.asp?id=192

30 November

Business demography

Births and deaths decrease between 2007 and 2008
www.statistics.gov.uk/cci/nugget.asp?id=2074

FORTHCOMING RELEASES

Future statistical releases on www.statistics.gov.uk

1 December

Mergers and acquisitions involving UK companies – Q3 2009

4 December

Output and employment in the construction industry – Q3 2009

8 December

Index of production – October 2009

9 December

UK Trade – October 2009

Regional economic activity (GVA) – December 2009

10 December

New orders in the construction industry – October 2009

Wealth in Great Britain – main results from the Wealth and Assets Survey 2006/2008

11 December

Producer price index – November 2009

Foreign Direct Investment – 2008

UK Business Enterprise Research and Development – 2008

15 December

Consumer price indices – November 2009

Engineering turnover and orders – October 2009

16 November

Labour market statistics – December 2009

Public sector employment – Q3 2009

Aerospace and electronic cost indices – September 2009

Annual Business Inquiry (Part 1 – Employment) – 2008

17 December

Overseas travel and tourism – October 2009

Retail sales – November 2009

Public and private breakdown of labour disputes – December 2009

18 December

Business investment – Q3 2009 revised results

Public sector finances – November 2009

Investment by insurance companies, pension funds and trusts – Q3 2009

22 December

Quarterly National Accounts – Q3 2009

UK Economic Accounts – Q3 2009

Balance of Payments – Q3 2009

Consumer Trends – Q3 2009

Financial Statistics – December 2009

Average weekly earnings (experimental) – October 2009

Productivity measures – Q3 2009

Index of services – October 2009

Economic review

December 2009

Graeme Chamberlin
Office for National Statistics

SUMMARY

The second estimate indicated that GDP fell by 0.3 per cent in 2009 Q3, marking the sixth successive quarterly fall in output. However, the pace of contraction has slowed since the turn of the year. This is reflected in the output indices of the production and services sectors, where the rate of decline has moderated in the last two quarters. The third quarter construction output figures showed growth after the previous falls, which will be reflected in future GDP estimates. There is some evidence that the vehicle scrappage scheme has had a positive effect, with the output of motor trades growing in the third quarter. On the expenditure side, household consumption, which had previously fallen for five successive quarters, was flat. The rate of decline in Gross Fixed Capital Formation also fell sharply, but net trade made a negative contribution to growth, as imports grew faster than exports. In the labour market, unemployment continued to rise, but the latest increase was the smallest since spring 2008. The greatest increases in unemployment and inactivity rates during the recession have been felt by the under 25 age groups. CPI inflation rose to 1.5 per cent in October from 1.1 per cent in September, partly reflecting the continued rise in motor fuel prices throughout 2009.

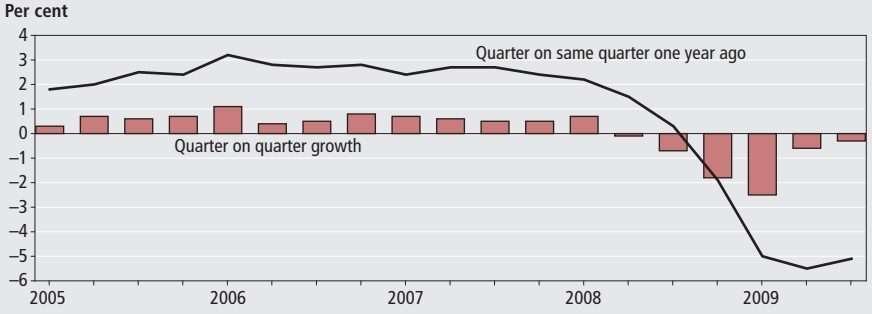
NATIONAL ACCOUNTS

UK economy contracts for sixth successive quarter

Gross Domestic Product (GDP) fell by 0.3 per cent in the third quarter of 2009. This is the second estimate for this quarter, and shows a slight upward revision of 0.1 percentage points from the Preliminary estimate published last month. These data confirm that the UK is yet to emerge from recession as output fell for a sixth successive quarter. But the pace of contraction has slowed considerably since the turn of the year. In the second quarter output fell 0.6 per cent; while in 2009 Q1 and 2008 Q4 the economy contracted at much faster rates of 2.5 per cent and 1.8 per cent respectively (see **Figure 1**).

GDP has now fallen by a total 5.9 per cent from its pre-recession level in 2008 Q1. This compares to the 2.6 per cent peak-to-trough fall in the early 1990s recession (1990 Q2 to 1991 Q3), and the 4.7 per cent fall in the early 1980s (1980 Q1 to 1981 Q1). The relative severity of the current and early 1980s recession partly reflects the global nature of these downturns. By contrast, the recession in the early 1990s was more centred on the UK, and because growth in the rest of the world at that time was more robust, external demand moderated the fall in domestic output.

Figure 1
GDP growth



Source: UK Output, Income and Expenditure

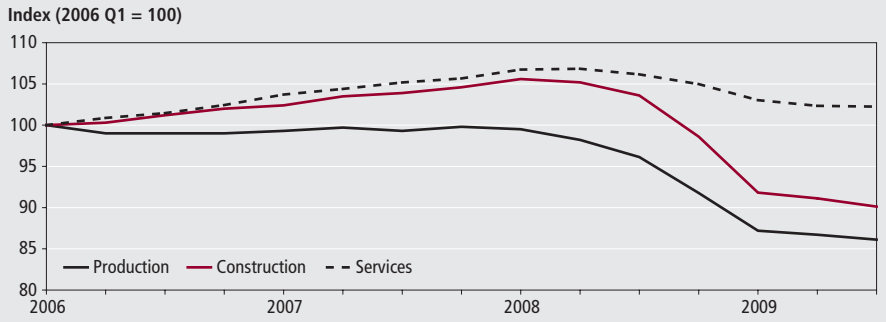
Largest output falls in the production and construction sectors

Figure 2 plots output indices for the production, construction and services sectors since 2006. In the two years leading up to the current downturn, UK growth was mainly accounted for by the services sector, which represents approximately 76 per cent of economic activity, and grew at an average annual rate of 3.3 per cent. Construction output also grew strongly in 2006 and 2007 at an average of 2.8 per cent each year. But as the sector only accounts for just over 6 per cent of total GDP its contribution to total growth was much smaller. In contrast, output in the production industries was broadly flat over these two years.

However, the production and construction sectors have been significant drivers of falling output in the current recession. Together they account for under a quarter of UK GDP, but were responsible for over half of the total fall in output during the last six quarters (that is 3.3 percentage points of the 5.9 per cent fall in GDP between 2008 Q1 and 2009 Q3). During these six quarters production output has fallen by a total of 13.4 per cent and construction output by a total of 15.5 per cent. So far, the cumulative loss of output in the entire services sector is 4.5 per cent.

A relatively large proportion of the output of the production industries is traded, so it is unsurprising that the sector has been adversely affected by a global downturn where all the major economies have entered a synchronised recession. For most of 2009, world trade was growing at its slowest rate since the Second World War. Furthermore, production sector

Figure 2
Output indices for production, construction and services



Source: UK Output, Income and Expenditure

output tends to be more volatile than services over the economic cycle due to changes in inventories. These refer to the work in progress and/or raw materials that firms hold to meet future demand. In a recession, when future demand is expected to fall, firms increasingly meet current demand by running down stocks rather than through production, so output falls quickly, even abruptly. But when demand picks up again, firms increase production not just to meet rising demand but also to replenish their inventories so as to meet future demand, in which case production picks up sharply.

The workings of this stocks cycle tends to increase the amplitude of the business cycle in sectors where stockholding is important such as manufacturing. By contrast, stockholding in the service sector is relatively low so output is usually less cyclical. This might explain why countries with a large industrial base, like Japan and Germany, experienced deeper than average recessions, but were also among the first economies to return to positive growth.

Heavy output falls have also been recorded in the UK construction industry. This is despite nearly half the output consisting of repair and maintenance which, compared with new work, is more stable over the economic cycle. Recorded falls in output are also despite large public sector infrastructure works, such as the Olympics, and the fiscal stimulus package that brought forward public sector maintenance work.

The main driver of the sharp fall in output in the second half of 2008 was the house building sector. Here the UK industry is fairly concentrated, meaning total output is accounted for by a relatively small number of firms. Nearly all of these announced, in the summer of 2008, that they were cutting back on projects and employment, in response to falling demand and prices, and growing stocks of unsold units. The commercial property market has since followed suit, as the economy entered recession and expected occupancy rates fell. The Investment Property Databank reported that UK commercial property values fell by a record amount in 2008, wiping out all of the gains in the previous five and a half years.

Broad-based falls in output

The Index of Production and the Index of Services provide a more detailed breakdown of output movements by industry. Both of these are now available up until September 2009, enabling a closer look at the patterns of growth than was possible at the time of the Preliminary GDP estimate – when data was only available for the first two months of the third quarter.

Looking at the production industries, the fall in output over the last year and a half has been broad-based (see **Figure 3**). Between 2008 Q1 and 2009 Q3, output of consumer durables and capital goods fell by 18.6 per cent and 17.7 per cent respectively, reflecting strong falls in consumer demand and business investment – both domestically and globally. The 5.4 per cent output loss in consumer non-durables was less severe. A large part of this industry is food processing, the demand for which tends to be more stable. Retail sales in predominately food stores exhibited a slight fall in the second half of 2008 and the first quarter of 2009, but have since returned to positive growth.

Intermediate goods and energy output, which make up just under a half of total UK production, fell by 15.7 per cent. This is consistent with the significant and widespread fall in global manufacturing, and also with the workings of the stocks cycle, which would suggest sharper falls in these products than in GDP as a whole.

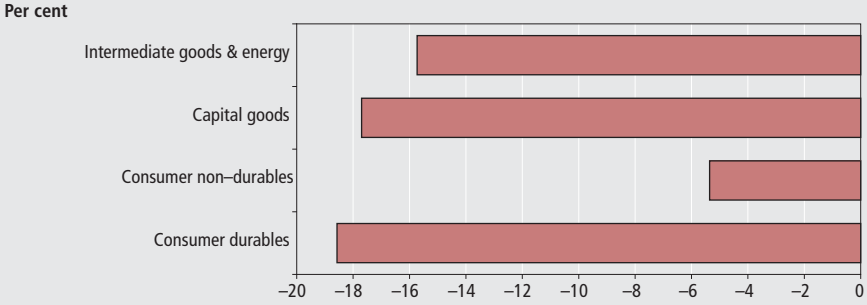
As Figure 2 shows, the pace of contraction in UK production was greatest in the second half of 2008 and at the turn of the year, but in the last two quarters has slowed. This, too, is broadly reflected across these categories of production.

Data from the Index of Services also shows that most industries have recorded significant output falls since 2008 Q1 (see **Figure 4**). However, due to the size and diversity of the sector, there are also some industries that have bucked the trend.

Over the last six quarters, output in the motor trades industry has fallen by 16 per cent. But this overall figure really masks a tale of two halves. Between January 2008 and May 2009, output fell by 20.1 per cent, as new car sales fell sharply in response to a tightening of consumer credit, a weakening labour market, falling consumer confidence and lower business investment in vehicles. However, in May, the car scrappage scheme came into affect – offering a subsidy of £2,000 towards the cost of a new vehicle for those trading in a vehicle over 10 years old – and since then output has rebounded by 11.4 per cent. It has also been reported that new vehicle sales have grown as households look to purchase before the expected VAT increase in January.

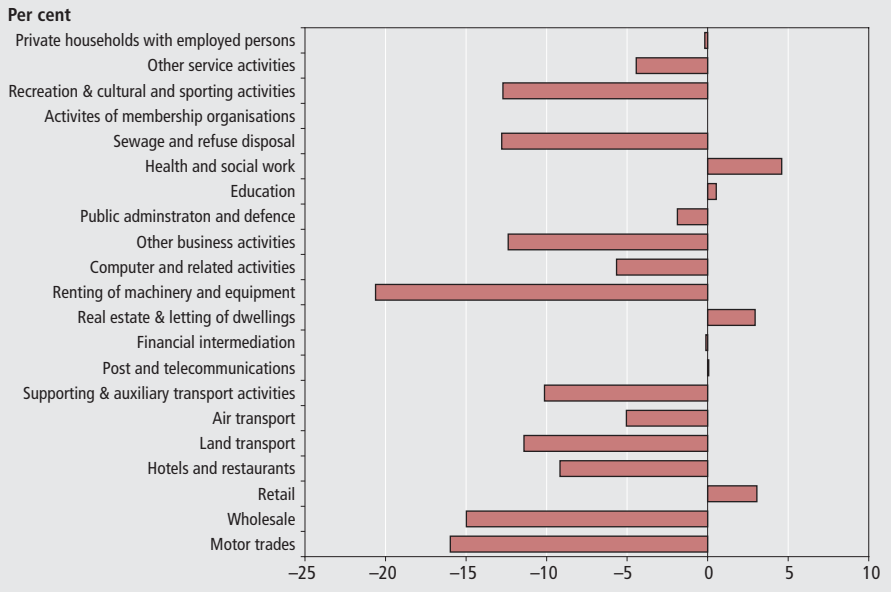
The Society of Motor Manufacturers

Figure 3
Production sector output, 2008 Q1 to 2009 Q3



Source: UK Output, Income and Expenditure

Figure 4
Output of the UK services sector, 2008 Q1 to 2009 Q3



Source: UK Output, Income and Expenditure

and Traders (SMMT) reported a 31.6 per cent increase in new car registrations in October compared to the same month last year (when they fell by 23 per cent on the year). It was also reported that fleet and business sector demand has grown. SMMT calculates that since May new car registrations have grown by 0.8 per cent, but if all scrappage volumes were removed, they would have fallen by 19.5 per cent.

The retail sector has maintained positive growth throughout the entire downturn, which is consistent with the robustness of retail sales volumes. The evidence here is that real spending is being supported by strong discounting and rapidly growing on-line sales.

Hotels and restaurants though have not fared so well. As a more discretionary component of consumer demand, output has fallen as households look to cut back on spending and strengthen their balance sheets (as shown by the rise in the household saving ratio from 1.7 per cent in 2008 Q3 to 5.6 per cent in 2009 Q2). The British Beer and Pub Association reported that in the first half of 2009, 52 pubs per week were closing down, up by a third on the previous year.

Transport industries have also experienced large output falls in the current recession. Land transport is down a total of 11.4 per cent, air transport down 5 per cent and supporting transport services are down by 10.1 per cent. Much of this reflects falling freight and cargo business, a consequence of the sharp slowdown in production output. Overseas travel and tourism have also fallen. According to the International Passenger Survey, visits to the UK from overseas between July and September 2009 were 9 per cent lower than in the same period a year earlier. Likewise, visits by UK residents overseas have also fallen, down 14 per cent over the same period.

Output in the post and telecommunications and the financial intermediation industries has been broadly flat. In the telecommunications sector, falling prices and new product developments may be underpinning demand. Financial intermediation has also been buoyed over the last year. Many of the services provided by the financial sector are not charged for explicitly with fees or premiums, but are paid for by spreads. For example, the buying and selling prices of financial assets such as foreign currency, and more importantly the interest rate differential between saving and borrowing rates. These have widened in the last year.

Real estate and lettings of dwellings recorded positive growth, despite the severe downturn in the housing market. However, it should be remembered that a large part of this output includes imputed rents. These are the rents owner-occupiers pay themselves for the housing services they provide to themselves, a convention applied to the National Accounts to enable GDP measures to be compared across countries where the proportions of renters and owner-occupiers differ. This element tends to be quite stable, mainly because the total amount of housing services consumed will grow alongside the housing stock.

Renting of machinery and equipment, computer and related activities, and other business services (which consists of many activities such as accountancy, legal, architecture and management consultancy) constitute over 30 per cent of UK gross valued added (GDP measured by the output approach). Together, they primarily represent business to business services, and output has fallen significantly over the last 6 quarters, by 20.7 per cent, 5.7 per cent and 12.4 per cent, respectively. As more discretionary parts of business spending, they are especially prone to being cut back in times of austerity.

The public administration, education and health and social work industries also account for over 30 per cent of GDP and contain a large element of public sector output. These have been fairly robust through the recession. Public administration, defence and compulsory social security output fell by 1.9 per cent, but was more than offset by the 0.5 per cent rise in education and 4.6 per cent increase in health and social work output.

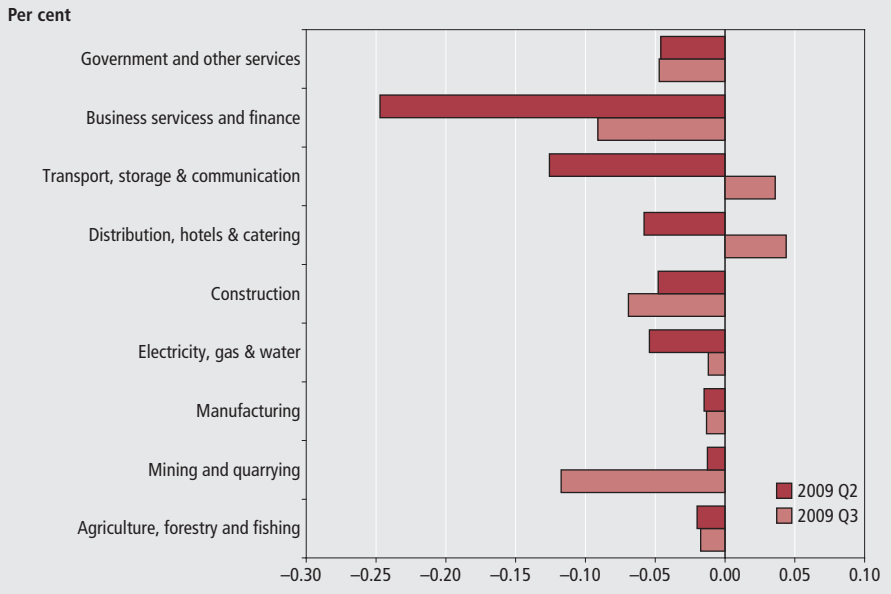
Two other industries which posted large output reductions were sewage and refuse disposal (down 12.8 per cent) and recreation, cultural and sporting activities (down 12.7 per cent). The first of these trends most likely reflects falls in business activity and household consumption. The second is likely to have been a victim of a retrenchment in discretionary spending by the household sector.

Pace of contraction continues to slow

Figure 1 shows the speed at which UK output is falling slowed in the two most recent quarters. This trend is also picked up in Figure 2, where the output of the production, construction and services industries begins to flatten out, after falling quickly in late 2008 and the first quarter of 2009. In the third quarter, output in both the manufacturing and services sector fell by just 0.1 per cent. The October Index of Production, published as this article was going to press, reported flat output in the latest three month period.Similar findings of an easing in the rate of contraction have been reported by several business surveys.

The British Chambers of Commerce (BCC) *Quarterly Economic Survey*, which covers 5,500 businesses employing 570,000 people in the UK stated that the third quarter results showed an improvement in all the key national balances, but the improvement was not sufficiently strong in their judgement to conclude, without doubt, that the economy had returned to positive growth.

Figure 5
Contributions to output growth in 2009 Q3 and 2009 Q2



Source: UK Output, Income and Expenditure

The *Purchasing Managers Index* (PMI) and the Confederation of British Industry's (CBI) *Industrial Trends Survey* both reported similar trends for UK manufacturing. Output has started to increase as the rate of de-stocking falls, but new orders remain weak and backlogs of work continue to fall. Both surveys identify capital goods producers as being particularly adversely affected by the recession compared to consumer and intermediate goods producers. The PMI reported a sixth successive monthly increase in output in November, but the increase was less rapid than in the October survey.

PMI data on the construction sector remained downbeat, reporting a 20th successive monthly fall in output in October, and a faster rate of decline than in September. However residential construction balances remained in positive territory for a second successive month. The commercial and civil engineering sectors though continued to fall, the latter at the fastest rate for 7 months.

Further evidence of an improvement in the house building sector was also provided by the National House Builders Council. New home starts were at their highest level for a year in the three months to October, and 27 per cent higher compared to the same period last year.

The revival may reflect the bounce in house prices that have occurred since April. The Halifax house price index increased by 7.1 per cent between April and October. The Land Registry index also reported five successive monthly increases up to October. The Royal Institute of Chartered Surveyors (RICS) identifies the shortage of properties coming on to the market as driving the recent price increases. However, the Nationwide house price index, the first to report for November, showed that the early 2009 growth in prices appears to be slowing.

Since the publication of the 'UK output, income and expenditure' Statistical Bulletin, ONS has published the 'Output in the construction industry' Statistical Bulletin pertaining to 2009 Q3. The total volume of construction output in the third quarter of 2009 rose by 2 per cent compared with the second quarter of 2009. The rise in repair and maintenance of 10 per cent was offset by a fall in new work of 4 per cent. This will be reflected in future GDP estimates.

Evidence on the services sector, though, is mixed. PMI data showed that activity and new business was at its highest positive balance for two years in October. Service sector output has now been growing for six successive months, and unlike the PMI data for manufacturing, output growth has been gaining momentum. New business was improving due to increased confidence among companies that had previously delayed expenditure. Financial intermediation, IT and computing were performing particularly well.

In contrast, the CBI *Quarterly Services Survey*, conducted in late October and early November, reported lower profits from a drop in sales and activity in both the business and professional services sector, and the consumer services sector. This resulted in the conclusion that the survey 'confirms the weakness reflected in third quarter GDP'. The CBI – PricewaterhouseCoopers *Financial Services Survey* reported that fee, commission and premium income has fallen in the third quarter. Although business volumes have picked up a little, they are still well below normal.

Figure 5 compares the contributions by main industries to output growth in the current and previous quarters. Three industries accounted for the majority of the improvement.

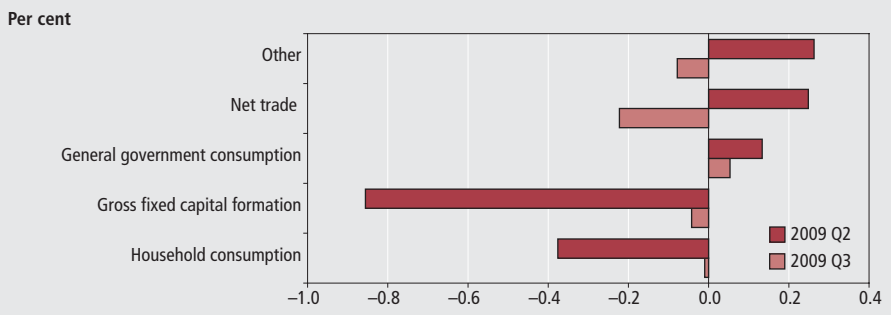
Distribution hotels and catering – where growth returned in the third quarter as output expanded by 0.3 per cent, compared to the 0.4 per cent fall in the second quarter. Here, the recent growth in motor trades was the pivotal factor. According to SMMT figures, 21 per cent of new car registrations in October were accounted for by the scrappage scheme, on a par with levels evident in previous months. The CBI *Distributive Trades Survey* reported that motor vehicle sales increased over the year to November 2009 for the first time since the year to May 2008.

Transport and communication – growth also returned, with output increasing by 0.5 per cent in quarter three following a 1.7 per cent contraction in quarter two. There is a suggestion that postal activities were brought forward in order to avoid the planned industrial action in November.

Business services and finance – although output fell by 0.3 per cent in the third quarter, this was a marked improvement from the previous quarter, when output fell by 0.8 per cent. As this sector accounts for a significant proportion of total value added, this improvement raised GDP growth by about 0.15 percentage points from what it would otherwise have been.

At this broad industry grouping, only the mining and quarrying sector recorded notably worse performance in the latest quarter. Output fell by 4.7 per cent compared to 0.7 per cent in the previous quarter. This was as a result of a large fall in oil and gas extraction, where output fell by 9.3 per cent in the month of August. Output in this industry can be volatile due to weather conditions and the timing of maintenance. But because the extraction industries only account for around 2.5 per cent of total GDP, the increased rate of contraction dragged down the rate of GDP growth between the second and third quarters by only 0.1 percentage points.

Figure 6
Contributions to expenditure growth in 2009 Q3 and 2009 Q2



Source: UK Output, Income and Expenditure

Falling consumption and investment expenditures level off

The *UK Output, Income and Expenditure* Statistical Bulletin presents the first data on the expenditure side of the National Accounts for a particular quarter. At this stage the available data is only at an aggregate level. The *Quarterly National Accounts* published one month later gives a much more detailed account of expenditure trends and also a full set of financial and sector accounts providing balance sheet information for the various parts of the economy. Also, *Consumer Trends* is published which reports on household spending patterns at a detailed level.

A breakdown of the contributions to GDP growth by main expenditure categories for 2009 Q3, and how it compares to 2009 Q2, is shown in **Figure 6**. At this stage a number of observations can be made.

First, household expenditure was flat in the third quarter, the first time since 2008 Q1 that it has not contracted. The car scrappage scheme may have had a positive effect. Retail spending, which makes up about a third of household spending has also been fairly robust throughout the recession. In the three months to October, this grew by 0.4 per cent relative to the previous three-month period, as spending in non-food stores was supported by discounting and through a strong rise in internet spending. Additionally, households may have brought on-line spending forward to avoid the postal strikes.

Second, there has been a sharp moderation in the decline of gross fixed capital formation (GFCF). In the first quarter of 2009 GFCF fell by 7.3 per cent, and then by a further 5.2 per cent in the second quarter. However, in the third quarter, the decline was just 0.3 per cent. Business surveys, though, have been pointing to weak investment intentions. The CBI *Industrial Trends Survey* reports that three-quarters of firms are working below capacity, so feel little need to invest in increasing output. The Engineering Employers Federation (EEF) reported that credit conditions have eased, but firms are more intent on de-leveraging than taking on new debts. The weakness in investment intentions is also consistent with the recent experiences of capital goods producers, where output has been weak.

Thirdly, there was a reversal in the positive contribution net trade had been making to GDP growth in previous quarters. In 2009 Q3, imports grew by 1.3 per cent, outstripping exports which only grew by 0.5 per cent. The improvement in consumer expenditure and GFCF may partly account for the stronger rise in imports.

Finally, the other category includes the contributions of non-profit institutions, changes in valuables, the statistical discrepancy, and also changes in inventories. In 2009 Q2, the rate of de-stocking fell making a positive contribution to growth. However, in the latest quarter, the rate at which inventories were being run down was largely unchanged. Furthermore, there was a 2 per cent fall in the consumption expenditure of non-profit institutions.

LABOUR MARKET

Unemployment increases by 30,000 in the third quarter, the smallest rise since Spring 2008

In the third quarter of 2009, unemployment rose by 30,000 to 2.461 million. This corresponds to an unemployment rate of 7.8 per cent, the highest recorded rate since the final quarter of 1996. Unemployment has now increased for 7 successive calendar quarters, and is up by 629,000 on the year. However, the latest increase marks the smallest rise since the three-month period March-May 2008, and the unemployment rate, which is reported to one decimal place, was unchanged from the second quarter (see **Figure 7**). It appears that the slowing rate of contraction in GDP is also being reflected in the labour market.

The rise in unemployment over the last year coincided with a sharp increase in the number of redundancies. The redundancy rate is given by the ratio of the redundancy level for the given quarter to the number of employees in the previous quarter, multiplied by 1,000. For July to September, the rate stood at 8.2, down considerably from 11.8 recorded in the three month period January-March (as shown in **Figure 8**).

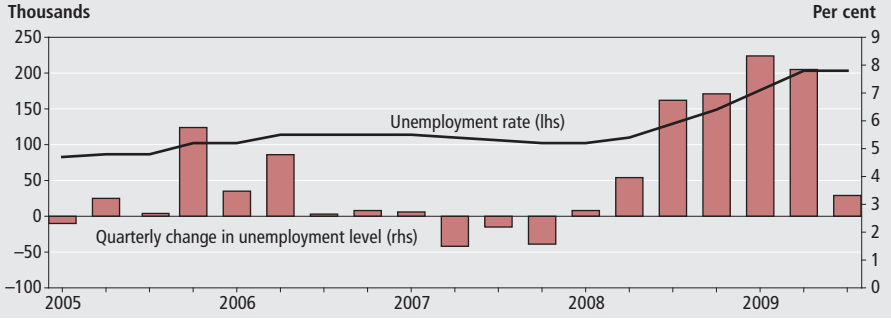
This is evidence that although redundancies remain at an elevated number and rate, there has been moderation of late. The speed at which the economy is contracting has slowed, suggesting a weaker pass through from output to the labour market. Business surveys have also indicated that firms have reduced employment as they restructure their businesses and look to cut costs in the face of weak/uncertain demand, especially in large companies. But, having already undertaken significant restructuring exercises, the need for further restructuring is diminishing, especially as the economy starts to stabilize.

While the redundancy rate is improving, there is no sign as yet of a pick up in vacancies. The vacancy rate is the number of vacancies per 100 employee jobs, with the published headline figure calculated as a three-month rolling average. The current vacancy rate of 1.6 per cent, based on the period August-October, has been broadly unchanged for most of 2009 and is down 0.6 percentage points on the same three month period in 2008 (see Figure 8).

Taking changes in the redundancy rate and vacancy ratio together provides evidence that firms are beginning to reduce the speed and number of workers laid off, but are still cautious about committing to hiring new workers. These trends are consistent with the overall movement in unemployment, which continues to rise, but now at a slower rate.

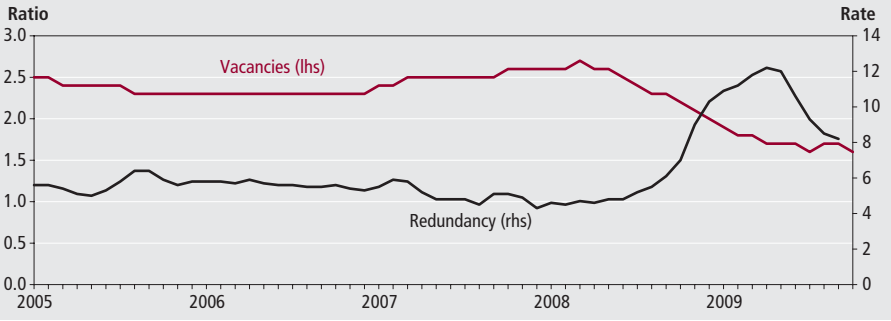
Official labour market data are also consistent with the employment balances

Figure 7
UK unemployment



Source: Labour Market Statistics

Figure 8
Vacancy rate and the redundancy ratio



Source: Labour Market Statistics

reported in the PMI surveys. In the services sector, job losses continued due to company restructuring and cost cutting but were at their lowest rate since September 2008. In manufacturing, job losses continued for the 19th successive month following redundancies linked to cost minimisation and efficiency programmes – but were at their slowest rate for one and a half years. The BCC *Quarterly Economic Survey* reported that employment balances improved but were still negative in the third quarter as firms looked to reduce the size of their workforce. However, manufacturing employment balances were at their highest since 2008 Q4 and services since 2008 Q3.

Unemployment durations on the rise

Although lower redundancies suggest a lower flow into unemployment, one of the possible consequences of a low vacancy rate is also a low exit rate from unemployment. This means that the sharp rise in unemployment towards the start of the recession could now be contributing to increasing durations of unemployment.

Figure 9 shows the numbers unemployed by duration over the last seven quarters. Clearly, as unemployment started rising in the second half of 2008, it was primarily reflected in durations of up to 6 months. However, as unemployment continues to rise, the proportion of unemployment accounted by durations of 6-12 months and 12-24 months has also started to pick up. Smaller increases in unemployment have coincided with a fall in the proportion of unemployed for up to 6 months.

In the third quarter of 2009, those unemployed for less than six months accounted for 53 per cent of total unemployment, compared to 61 per cent a year earlier. The proportions unemployed for 6 to 12 months and 12 to 24 months increased from 15.4 per cent to 21.8 per cent and 12.5 per cent to 15.6 per cent respectively. The number of very long-term unemployed (over 24 months) has not yet risen, and as a result makes up a smaller proportion of total unemployment due to recent increases at shorter durations.

Unemployment and inactivity increases the most for younger people

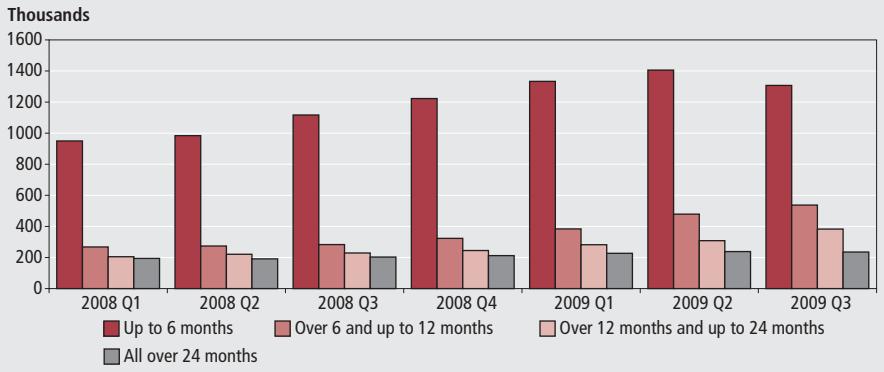
Since the start of the recession the unemployment rate has increased from 5.2 per cent in 2008 Q1 to 7.8 per cent in 2009 Q3. However, as **Figure 10** shows, the increase has differed between age groups.

16 and17 year olds have experienced an 8.1 percentage point rise in their unemployment rate to 32.4 per cent. In the 18-24 age category, the unemployment rate increased by 5.8 percentage points to 18 per cent. In the 25 to 49 age category the rise in unemployment was by 2.4 percentage points to 6.3 per cent. Finally, for those aged 50 and above the unemployment rate grew by 1.6 percentage points to 4.4 per cent. These trends imply that the recession has had a disproportionate impact on younger people in the labour market.

As younger people are more reliant on graduate and other entry level recruitment schemes, their employment prospects are likely to be more sensitive to the prevailing low vacancy rate. Furthermore, firms have been reporting in business surveys that they have been reducing the size of their workforces by not replacing older workers who retire or leave.

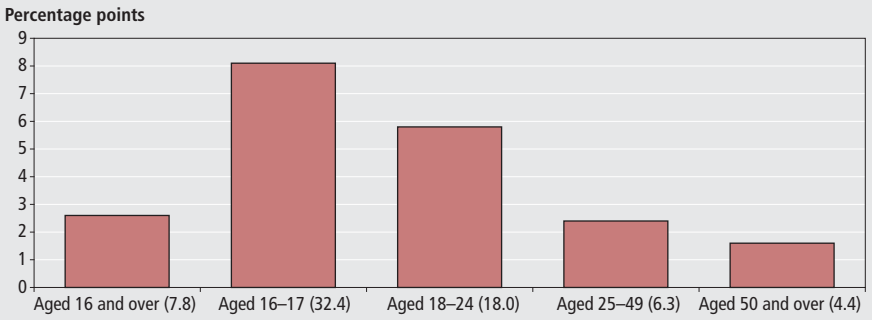
Similar age-related patterns can also be seen in inactivity (see **Figure 11**). Between 2008 Q1 and 2009 Q3, the working age

Figure 9
Unemployment by duration, 2008 Q1 to 2009 Q3



Source: Labour Market Statistics

Figure 10
Changes in the unemployment rate by age, 2008 Q1 to 2009 Q3



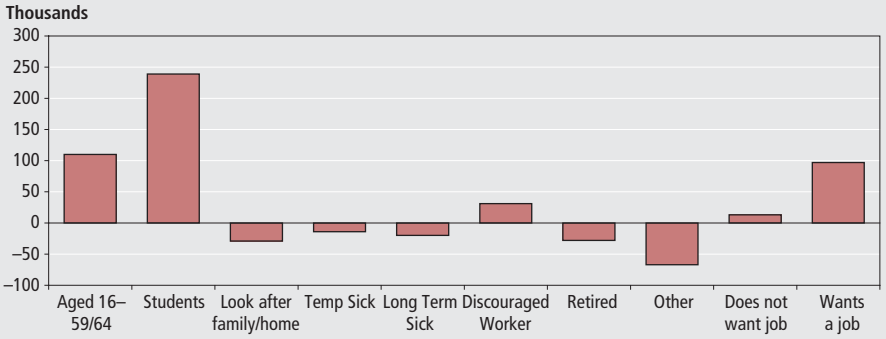
Note:
1 Actual unemployment rates in 2009 Q3 in brackets.

Source: Labour Market Statistics

Figure 11
Changes in inactivity rates by age, 2008 Q1 to 2009 Q3

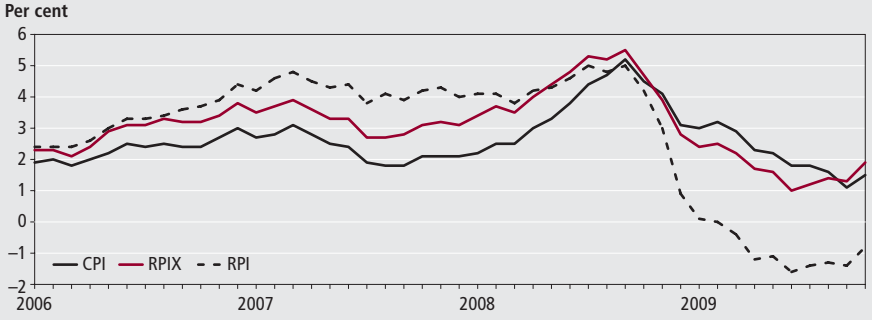
Source: Labour Market Statistics

Figure 12
Changes in the numbers of inactive by stated reason, 2008 Q1 to 2009 Q3



Source: Labour Market Statistics

Figure 13
Consumer prices inflation



Source: Consumer Prices

inactivity rate increased by 0.2 percentage points. However, for the 16-17 and 18-24 age categories, there were 6.1 and 2.2 percentage point increases in inactivity rates. For all the older age categories, including those beyond state retirement age, inactivity rates have been falling further during the course of the recession.

Figure 12 looks at the stated reasons for inactivity. Total working age inactivity increased by 110,000 between 2008 Q1 and 2009 Q3, and over the same period the number of students rose by 239,000. The only other category where inactivity increased was the discouraged worker – which is also consistent with the weakening labour market.

Figures 13 and 14 therefore imply that the impact of the recession on younger people is not just manifest in rising unemployment, but also in inactivity. It appears that poor labour market conditions have further encouraged younger people to stop seeking work and move into further/higher education.

PRICES

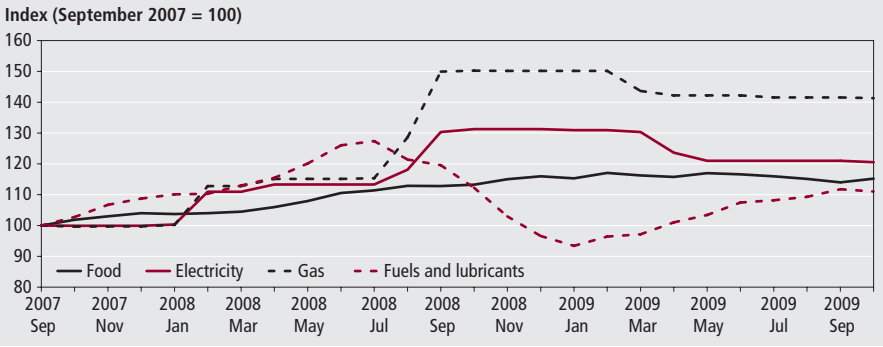
CPI inflation back up to 1.5 per cent in October

The annual rate of inflation, as measured by the Consumer Prices Index (CPI), was 1.5 per cent in October. In September annual CPI inflation was 1.1 per cent, and in August it was 1.6 per cent. Recent fluctuations are largely the result of last year's significant increases in food and energy prices beginning to drop out of the equation. CPI inflation peaked at 5.2 per cent in September 2008. (see **Figure 13**).

The Retail Prices Index reported a 0.8 per cent fall in October compared to the same month a year earlier, and has been in negative territory since March 2009. However, the rate of deflation in recent months has stabilised and now appears to be starting to reverse. The main factor accounting for negative growth in the RPI has been the large cut in mortgage interest payments following the reduction in the Bank of England base rate to 0.5 per cent. RPIX excludes the impact of mortgage interest payments, and this has behaved in a similar way to the CPI.

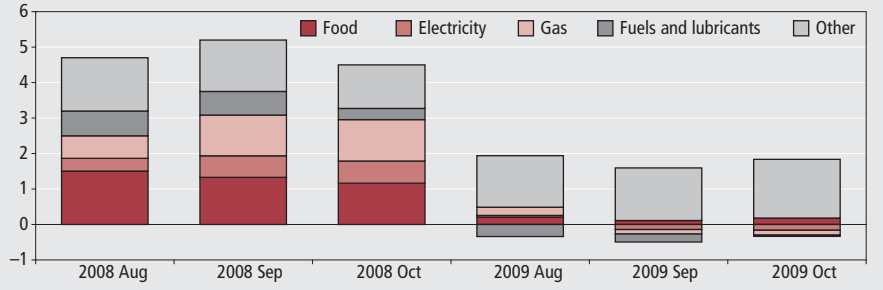
To understand better some of the recent movements in CPI inflation it is worth looking at recent trends in food and energy prices (see **Figure 14**). CPI inflation peaked at 5.2 per cent in September 2008 – this was driven by sustained price

Figure 14
Indices of food and energy prices inflation



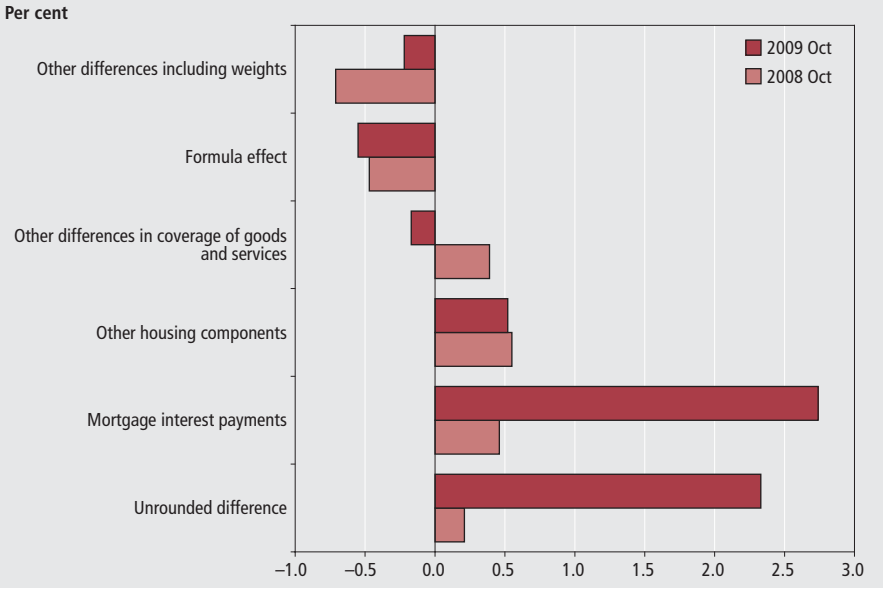
Source: Consumer Prices

Figure 15
Contributions to CPI inflation



Source: Consumer Prices

Figure 16
Breaking down the difference between CPI and RPI inflation



Source: Consumer Prices

increases over the course of the previous year in:

Food: Prices rose by 10.7 per cent between September 2007 and September 2008. As this component accounts for just over 10 per cent of the all-items CPI, it has a significant effect on total inflation.

Electricity: Over the same period prices rose by 30.4 per cent, including a 10.3 per cent increase between August and September 2008.

Gas: Prices rose by 50.5 per cent reflecting sharp increases in wholesale gas prices. Between August and September 2008 prices rose by 16.6 per cent.

Motor fuels and lubricants: These prices are mainly governed by the oil price, which peaked at over $138 per barrel in July 2008, feeding through quickly to petrol prices. Although prices had started to fall by September, they were still 16.4 per cent above their level in September 2007. As the global economy moved into recession and the oil price fell to below $40 per barrel, the prices of motor fuels fell sharply in the second half of 2008. However, prices have risen steadily throughout 2009 as the oil price has recovered. Between January 2009 and October 2009, motor fuel prices in the CPI had risen by 18.9 per cent.

As CPI inflation rates are reported as an annual comparison, the effects of significant price movements will stay in the index for a year before dropping out. Therefore the rate of inflation is not just sensitive to current price movements, but also those that happened in the recent past. **Figure 15** shows the main contributions to CPI inflation in the months of August, September and October in both 2008 and 2009. Clearly the sharp rise in food, electricity, gas and motor fuel prices accounted for most of the rise in inflation rates last year. But as these have subsequently dropped out of the inflation calculation, CPI inflation has fallen markedly.

The 0.5 percentage point fall in CPI inflation between August and September 2009 is mainly the result of the sharp increases in electricity and gas prices the year earlier dropping out of the annual comparison. At the time, these contributed around 0.5 percentage points to the all-items inflation rate.

The small jump in inflation in October is partly accounted for by the recent increases in motor fuel prices. As the rise in these prices during the first half of the year were less rapid than in 2008, the overall contribution to CPI inflation has recently been negative (despite the sustained price rise throughout 2009). However, as motor fuel prices continue to rise they will replace the falls that occurred in the second half of 2008 in the index, and as a result the contribution of motor fuels to overall inflation will increase (or be less negative as in the case of the October CPI). This effect added about 0.2 percentage points to the October CPI inflation rate.

2.3 percentage points difference between CPI and RPI inflation rates

The 12-month increase in CPI in October was 1.5 per cent while the RPI fell by 0.8 per cent. **Figure 16** shows the relative contribution of different

factors in accounting for the 2.3 percentage point difference between the two measures of inflation in consumer prices.

The main difference is the contribution of mortgage interest payments to inflation which are included in the RPI but not the CPI. The significant cuts in interest rates made by the Bank of England to support the economy through recession have been passed on to variable rate mortgages, hence pushing down significantly on RPI inflation rates (by 2.74 per cent relative to the CPI in October). The difference between RPI and CPI inflation when this effect is ignored, as shown by the comparison of RPIX and CPI inflation in Figure 13, is much smaller. When the effects of falling mortgage interest rates fall out of the annual comparison, the RPI measure will jump upwards, other things being equal.

Other housing components predominately consists of depreciation, the value of which is intrinsically linked to house prices. These are included in the RPI but not the CPI. As house prices are lower than they were a year ago, this, too, has pulled RPI inflation down relative to the CPI, by 0.5 per cent in October. Therefore, the sum of these two housing effects accounts for more than the difference between the two inflation measures (3.3 per cent compared to a difference of 2.3 per cent).

Other differences in coverage and weighting refer to the types of goods and services and their relative importance in making up the representative baskets used to produce the index. In the latest month, these effects increased the CPI relative to the RPI by around 0.4 percentage points.

The final difference is the formula effect, which has tended to lower the CPI inflation rate relative to the RPI inflation rate by around 0.5 percentage points in most periods. CPI is calculated as a geometric mean, whereas RPI is calculated as an arithmetic mean. Because the geometric mean is always less than or equal to the arithmetic mean of the same data, it implies that if everything were held equal (weights and coverage) the CPI inflation rate would generally be lower than the RPI inflation rate – in this case by around 0.5 percentage points.

Independent forecasts

November 2009

UK forecasts

The tables below supplement the Economic Review by providing a forward-looking view of the UK economy. The tables shows the average and range of independent forecasts for 2009 and 2010 and are extracted from HM Treasury's Forecasts for the UK Economy.

2009

	Average	Lowest	Highest
GDP growth (per cent)	*–4.5*	*–4.7*	*–3.9*
Inflation rate (Q4, per cent)			
CPI	*1.7*	*1.2*	*2.5*
RPI	*–0.2*	*–2.1*	*1.0*
Claimant count (Q4, million)	1.71	1.58	1.87
Current account (£ billion)	–27.5	–38.3	–15.0
Public Sector Net Borrowing (2009–10, £ billion)	177.0	134.6	220.0

2010

	Average	Lowest	Highest
GDP growth (per cent)	*1.2*	*–0.5*	*2.0*
Inflation rate (Q4, per cent)			
CPI	*1.8*	*1.1*	*3.7*
RPI	*2.8*	*1.4*	*4.4*
Claimant count (Q4, million)	1.92	1.57	2.30
Current account (£ billion)	–23.6	–61.4	–8.0
Public Sector Net Borrowing (2010–11, £ billion)	180.5	148.0	215.0

Notes

Forecast for the UK economy gives more detailed forecasts, and is published monthly by HM Treasury. It is available on the Treasury's website at: www.hm-treasury.gov.uk/data_forecasts_index.htm

Selected world forecasts

The tables below supplement the Economic Review by providing a forward-looking view of the world economy. The tables show forecasts for a range of economic indicators taken from *Economic Outlook* (November 2009), published by OECD (Organisation for Economic Co-operation and Development).

2009

	US	Japan	Euro area	Total OECD
Real GDP growth (per cent)	*2.5*	*1.8*	*0.9*	*1.9*
Consumer price (percentage change from previous year)	*1.7*	*–0.9*	*0.9*	*..*
Unemployment rate (per cent of the labour force)	*9.9*	*5.6*	*10.6*	*9.0*
Current account (as a percentage of GDP)	*–3.4*	*2.8*	*–0.1*	*–0.8*
Fiscal balance (as a percentage of GDP)	*–10.7*	*–8.2*	*–6.7*	*–8.3*

2010

	US	Japan	Euro area	Total OECD
Real GDP growth (per cent)	*2.8*	*2.0*	*1.7*	*2.5*
Consumer price (percentage change from previous year)	*1.3*	*–0.5*	*0.7*	*..*
Unemployment rate (per cent of the labour force)	*9.1*	*5.4*	*10.8*	*8.8*
Current account (as a percentage of GDP)	*–3.7*	*2.8*	*0.3*	*–0.8*
Fiscal balance (as a percentage of GDP)	*–9.4*	*–9.4*	*–6.2*	*–7.6*

Notes

The OECD *Economic Outlook* is published bi-annually. Further information about this publication can be found at www.oecd.org/eco/Economic_Outlook

Key indicators

The data in this table support the Economic review by providing some of the latest estimates of Key indicators.

Seasonally adjusted unless otherwise stated

	Source CDID	2007	2008	2009 Q1	2009 Q2	2009 Q3	2009 Aug	2009 Sep	2009 Oct
GDP growth – chained volume measures (CVM)									
Gross domestic product at market prices	ABMI	2.6	0.6	–2.5	–0.6	–0.3	..	..	..
Output growth – chained volume measures (CVM)									
Gross value added (GVA) at basic prices	ABMM	2.6	0.6	–2.5	–0.6	–0.3	..	..	..
Industrial production	CKYW	0.3	–3.1	–5.0	–0.6	–0.7	–2.6	1.5	..
Manufacturing	CKYY	0.6	–2.9	–5.3	–0.1	–0.1	–2.0	1.7	..
Construction	GDQB	2.7	–0.4	–6.9	–0.8	–1.1	..	..	..
Services	GDQS	3.5	1.4	–1.9	–0.7	–0.1	..	..	..
Oil and gas extraction	CKZO	–2.2	–5.1	–1.8	–0.7	–5.1	–8.0	1.6	..
Electricity, gas and water supply	CKYZ	0.2	0.0	–3.8	–3.6	–0.8	–0.6	–0.3	..
Business services and finance	GDQN	5.6	2.5	–2.9	–0.8	–0.3	..	..	..
Household demand									
Retail sales volume growth	EAPS	4.2	2.6	0.2	0.8	1.1	0.0	0.4	0.4
Household final consumption expenditure growth (CVM)	ABJR	2.5	0.9	–1.5	–0.6	0.0	..	..	..
GB new registrations of cars (thousands)[1]	BCGT	..	..	..	..	..	..	..	..
Labour market[2,3]									
Employment: 16 and over (thousands)	MGRZ	29,222	29,443	29,168	28,921	28,927	28,927	..	..
Employment rate: working age (%)	MGSU	74.6	74.5	73.5	72.7	72.5	72.5	..	..
Workforce jobs (thousands)	DYDC	31,471	31,661	31,160	30,997	..	..	..	..
Total actual weekly hours of work: all workers (millions)	YBUS	936.1	940.7	918.1	917.8	910.7	910.7	..	..
Unemployment: 16 and over (thousands)	MGSC	1,653	1,776	2,227	2,432	2,461	2,461	..	..
Unemployment rate: 16 and over (%)	MGSX	5.3	5.7	7.1	7.8	7.8	7.8	..	..
Claimant count (thousands)	BCJD	863.6	905.1	1,366.7	1,533.2	1,605.2	1,606.0	1,626.6	1,639.5
Economically active: 16 and over (thousands)	MGSF	30,875	31,220	31,395	31,353	31,389	31,389	..	..
Economic activity rate: working age (%)	MGSO	78.9	79.1	79.3	79.0	78.9	78.9	..	..
Economically inactive: working age (thousands)	YBSN	7,940	7,872	7,843	7,956	7,997	7,997	..	..
Economic inactivity rate: working age (%)	YBTL	21.1	20.9	20.7	21.0	21.1	21.1	..	..
Vacancies (thousands)	AP2Y	657	618	465	434	430	432	430	428
Redundancies (thousands)	BEAO	127	163	299	267	205	205	..	..
Productivity and earnings annual growth									
GB average earnings (including bonuses)[3]	LNNC	..	..	–0.5	2.5	1.2	1.6	1.2	..
GB average earnings (excluding bonuses)[3]	JQDY	..	..	3.0	2.4	1.8	1.9	1.8	..
Whole economy productivity (output per worker)	A4YN	..	..	–4.4	–3.9	..	..	..	..
Manufacturing productivity (output per job)	LOUV	..	..	..	..	..	–2.4	–1.5	..
Unit wage costs: whole economy	LOJE	..	..	4.5	5.7	..	..	..	..
Unit wage costs: manufacturing	LOJF	..	..	..	..	..	3.7	3.1	..
Business demand									
Business investment growth (CVM)	NPEL	11.9	1.4	–8.9	–10.2	–3.0	..	..	..
Government demand									
Government final consumption expenditure growth	NMRY	1.2	2.5	0.1	0.6	0.2	..	..	..
Prices (12-monthly percentage change – except oil prices)[1]									
Consumer prices index	D7G7	2.3	3.6	3.0	2.1	1.5	1.6	1.1	1.5
Retail prices index	CZBH	4.3	4.0	–0.1	–1.3	–1.4	–1.3	–1.4	–0.8
Retail prices index (excluding mortgage interest payments)	CDKQ	3.2	4.3	2.4	1.4	1.3	1.4	1.3	1.9
Producer output prices (excluding FBTP)[4,5]	PLLV	1.9	4.7	3.6	1.3	0.7	0.8	1.3	2.0
Producer input prices[5]	RNNK	3.0	21.6	0.7	–8.9	–8.7	–7.7	–6.2	0.1
Oil price: sterling (£ per barrel)	ETXR	36.11	52.10	31.33	38.44	42.05	44.17	41.81	43.45
Oil price: dollars ($ per barrel)	ETXQ	72.44	98.37	44.94	59.82	69.02	72.99	68.32	70.35

Seasonally adjusted unless otherwise stated

	Source CDID	2007	2008	2009 Q1	2009 Q2	2009 Q3	2009 Aug	2009 Sep	2009 Oct
Financial markets[1]									
Sterling ERI (January 2005=100)	BK67	103.6	90.8	77.3	80.8	82.5	83.4	80.9	79.1
Average exchange rate /US$	AUSS	2.0018	1.8528	1.4346	1.5503	1.6411	1.6539	1.6328	1.6199
Average exchange rate /Euro	THAP	1.4619	1.2588	1.1010	1.1389	1.1475	1.1597	1.1212	1.0928
3-month inter-bank rate	HSAJ	5.95	2.75	1.60	1.15	0.55	0.70	0.55	0.50
Selected retail banks: base rate	ZCMG						0.50	0.50	..
3-month interest rate on US Treasury bills	LUST	3.29	0.11	0.13	0.20	0.14	0.15	0.14	0.07
Trade and the balance of payments									
UK balance on trade in goods (£m)	BOKI	–89,754	–93,446	–20,796	–19,886	–19,782	–6,073	–7,194	..
Exports of services (£m)	IKBB	150,645	170,853	42,329	39,387	38,515	13,348	13,225	..
Non-EU balance on trade in goods (£m)	LGDT	–47,768	–53,963	–12,531	–10,967	–10,720	–3,060	–3,783	..
Non-EU exports of goods (excl oil & erratics)[6]	SHDJ	98.8	105.8	92.6	92.4	96.3	99.0	95.4	..
Non-EU imports of goods (excl oil & erratics)[6]	SHED	113.3	113.5	100.8	96.1	95.8	95.1	96.3	..
Non-EU import and price index (excl oil)[6]	LKWQ	102.6	115.3	130.9	126.3	122.7	122.0	124.1	..
Non-EU export and price index (excl oil)[6]	LKVX	101.8	109.8	121.5	118.4	116.7	116.2	117.4	..
Monetary conditions/government finances									
Narrow money: notes and coin (year on year percentage growth)[7]	VQUU	5.8	7.3	8.4	8.7	8.7	8.9	8.7	7.7
M4 (year on year percentage growth)	VQJW	12.9	13.1	17.9	13.6	11.6	12.3	11.6	10.8
Public sector net borrowing (£m)	–ANNX	34,217	60,694	22,068	40,408	35,110	14,090	14,917	11,419
Net lending to consumers (£m)	RLMH	12,938	11,153	189	458	–955	–373	–262	–579

External indicators – non-ONS statistics

		2009 Apr	2009 May	2009 Jun	2009 Jul	2009 Aug	2009 Sep	2009 Oct	2009 Nov
Activity and expectations									
CBI output expectations balance[1]	ETCU	–32	–17	–17	–14	–5	–2	4	4
CBI optimism balance1	ETBV	–40			–16			10	
CBI price expectations balance	ETDQ	–18	–14	–8	–13	5	–6	–4	–5

Notes: *Source: Office for National Statistics*

1 Not seasonally adjusted.
2 Annual data are the average of the four quarters except for workforce jobs (June).
3 Monthly data for vacancies and average earnings are averages of the three months ending in the month shown. Monthly data for all other series except claimant count are averages of the three months centred on the month shown.
4 FBTP: food, beverages, tobacco and petroleum.
5 Now derived from not seasonally adjusted series.
6 Volumes, 2003 = 100.
7 Replacement for series M0 which has ceased publication.

Further explanatory notes appear at the end of the Key times series section.

ARTICLE

The characteristics of patenters

Peter Evans and M. Khalid Nadeem Khan
Office for National Statistics

SUMMARY

This article describes how patents data from the Intellectual Property Office are being matched with detailed firm-level data from the Office for National Statistics. The resulting database will provide a gateway for future research on firm-level innovation and technical change. Preliminary results are presented showing the characteristics of patenting businesses, the rate of patent renewal, and the regional distribution of patenting activity. The article also highlights future areas of research that can develop the evidence base for patent and innovation policy.

Introduction

Patent data are an early indicator for understanding technical change and innovation. It has offered insight into scientific progress and the structural change of economies. The main focus of this article is to understand who patents and what is being patented.

The inter-linkage between patents, research and development, trade in intangible assets and various other issues, at the national and international levels, has drawn the attention of policy makers. Policy makers seek to improve the effectiveness of the patent system to promote innovation, and the policy interest motivates a deeper investigation of the patent data.

Such investigation requires detailed business level data, not only for patents and patenters, but for research and development, international trade in intangible assets and business structure. These data are not easy to collect and such a process is very costly. An indirect way of achieving the same objective is to use existing data from various sources and match it to patent data.

The Office for National Statistics (ONS) and the Intellectual Property Office (IPO) have started a joint project to create a dataset by matching patent data with ONS business data. The initial stages of this project have been completed and the results of the match are promising, indicating that the dataset can be used to answer many policy questions.

This article covers the methodology of matching, provides some preliminary analysis, and indicates how important policy questions could be answered through matching with other ONS datasets.

The article is organised into the following sections:

- a description of the ONS and IPO data
- step-by-step details of the data matching
- a preliminary analysis of the matched data to investigate the characteristics of patenters: looking at patenting businesses, patenting intensity and the regional distribution of patents
- an analysis of the patent renewal rate, considering the life-length of patents
- a look at the potential for further matching and the usefulness of matched data
- concluding remarks

IPO and ONS data

Before describing the matching process, it is useful to understand the nature of the two datasets and their affect on matching. This section covers the IPO and ONS datasets, with regard to the coverage and information they provide.

IPO Data

The IPO is the legal body that grants patents within the UK, and therefore is the main source of patent information for the UK. For this study, the IPO provided data that contained 35,384 patents from January 1999 until September 2008.[1] This dataset only covers businesses and provides information on successful

patents. These are patents that were filed and subsequently granted.

The IPO data provide the following information:

- agent, applicant and proprietor name
- patent filing/application date[2]
- patent granting date, and
- patent renewal information

It is useful to explain a few of these terms. The agent is an individual or business that applies for a patent on behalf of the inventor. The applicant is the organisation on whose behalf an agent applies for the patent. The proprietor is the legal owner of the patent, which is either reported on the patent application or is the entity that has renewed the patent. The economic owner is of interest for policy purposes because it identifies the inventor and subsequently the beneficiary of returns from the patenting rights. Therefore, this discussion and preliminary results use proprietor as a point of reference, unless stated otherwise.

Since a UK patent currently takes an average of three years from filing to granting, it is useful to understand an exception to the normal patent process. In cases where one application is further divided into two patent applications (known as 'divisionals'), the second patent is given a new filing/application date, reflecting when this application was received, but the actual filing/application date remains the date when the original patent was filed. This complication needs to be treated and interpreted carefully. **Figure 1** presents the number of patents filed in each year – as mentioned previously, this dataset contains information on patents that were subsequently granted.

Figure 1 depicts two interesting trends. Firstly, until 2004 the trend in patent applications is somewhat similar. Secondly, there is a significant decline from 2005, which requires further exploration. The IPO annual review claims a 5 per cent decline in the filing and granting of patents,[3] yet this is not a satisfactory justification as Figure 1 shows a sharper decline. The answer lies in the patenting process. Since we have data until 2008, it is likely that a sizeable number of patents are still in the application process and yet to be granted.

There is known to be a level of inaccuracy within Figure 1 as this dataset uses the filing/application date. As stated previously, this is accurate unless there is a preceding filing/application date. A preceding filing/application date is required for divisionals or patents filed under the Patent Cooperation Treaty (PCT). When a patent is applied for through the PCT system, many steps of the patenting process are completed prior to the application reaching the national patent office. Therefore, the priority date for PCT applications is the date of the patent application made in the original country.

This inaccuracy has further implications for the analysis presented within this article. At present, it is not possible to determine how many patents are divisionals or were applied for via the PCT, which results in a possible under/over statement within each period[4].

Figure 1 is a snapshot of annual patenting activity, but the level of analysable data in the dataset allows for a life-length perspective of patent stock. **Figure 2** shows the stock of patents in the matched dataset, depicting how many of the 35,384 patents are added to the patent stock and how many die within a given year. Patents are required to be renewed after their first five years of existence (starting from the filing/application date), the first occurrence of patent death is in 2003.[5]

ONS data

The Business Structure Database (BSD) holds business information on the vast majority of businesses operating within the UK (in 2006 the BSD covered 3.3 million businesses). The BSD is an annual download from the Inter-departmental Business Register (IDBR) which is a live database of business information based on HM Revenue and Customs (HMRC), Dunn and Bradstreet[6] business information, ONS surveys and Companies House data.

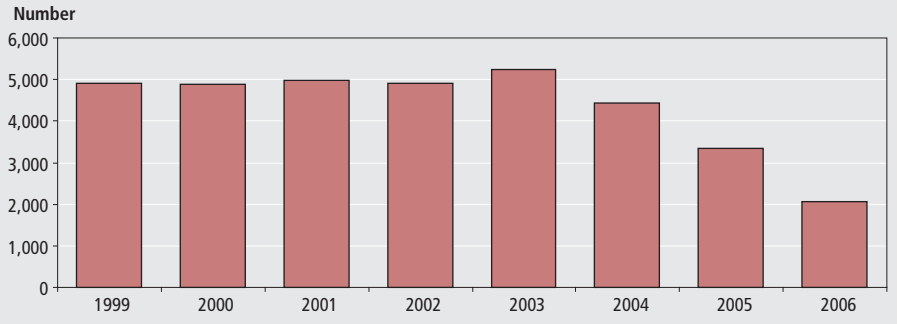
The BSD provides the information shown in **Table 1**[7].

It is worth noting that, once patent and BSD data are matched, further matching with other ONS datasets (such as the Business Enterprise Research and Development dataset, BERD) becomes relatively straightforward as all ONS datasets contain a point of reference attained from the IDBR.

Matching IPO and ONS data

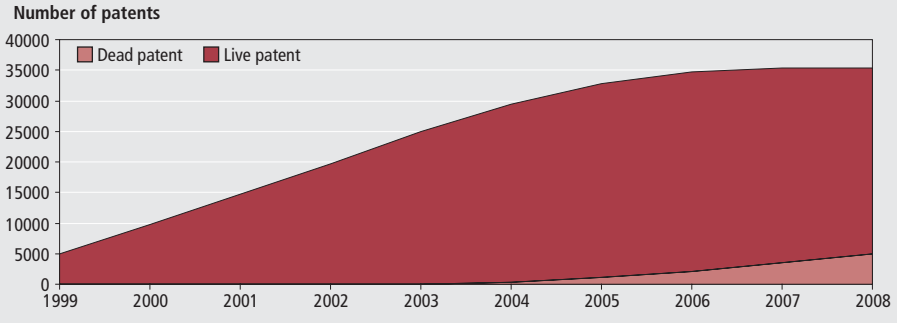
In the absence of a common business identifier in both the datasets it is difficult to match IPO and ONS data. However, since both these datasets contain business names, a name-based matching method is used. It should be noted that each patent may have three business names (representing an agent, applicant, and proprietor). Therefore all three names are matched with corresponding names within the IDBR and, through this link,

Figure 1
Number of patents



Source: Intellectual Property Office

Figure 2
Patent activity



Source: Intellectual Property Office

Table 1
Variables contained within the BSD

Definition	BSD variables
IDBR identifier code	Enterprise ref
Reference of parent organisation	Enterprise group ref (wow)
Postcode	Postcode
Foreign ownership marker	Immediate foreign ownership
Foreign ownership marker	Ultimate foreign ownership
Employment for enterprise	Employment
Turnover for enterprise	Turnover
SIC92, SIC03, SIC07 (depending on year)	Standard Industrial Classification
Year business began trading	Birth date
Year business stopped trading	Death date
Number of local units that make up the enterprise	Number of local units
Number of reporting units that make up the enterprise	Number of reporting units
Legal status of enterprise (e.g. company, partnership, sole proprietor)	Status

Source: Office for National Statistics

Table 2
Matching results of IPO and ONS data

IPO data category	Number of patents	Percentage of patents
Matched data		
Agent, Applicant and Proprietor	12,298	*34.76*
Applicant and Proprietor	729	*2.06*
Agent and Proprietor	1,161	*3.28*
Agent and Applicant	731	*2.07*
Proprietor only	243	*0.69*
Applicant only	55	*0.16*
Agent only	17,759	*50.19*
Subtotal	**32,976**	***93***
Unmatched data		
IPO data that could not be matched to business name	**2,408**	***6.81***
Total	**35,384**	***100***

Source: Intellectual Property Office and Office for National Statistics

are matched with an enterprise reference number. This section documents the matching process in detail:

Data matching

The IDBR team was provided with:

- the name and address of the entity that filed the agent
- the name of the applicant
- the name of the entity listed as proprietor
- IPO unique patent number (available for agents) or a unique reference number created for applicants and proprietors

Subsequently, the patent data was split into two subsets: one with agents, another with applicants and proprietors. In order to improve the probability of matching, the names of patenters were standardised. For example, *Company X Limited*, *Company X plc* and *Company X* would be altered to *Company X*. This reduces the number of observations that cannot be matched because of different name recording conventions, and minimises time as fewer names are matched. In the final step, the matched file, based on name, is reattached to the original IPO dataset using the unique patent numbers mentioned above.

The patent dataset

After matching by name, the patent dataset has an IDBR enterprise reference number for agent, applicant and proprietor[8]. Each observation also contains information regarding:

- date of application of the patent
- date that the patent was granted, and
- the age of the patent if older than 5 years

The inclusion of the enterprise reference number allows the final piece of matching, between the patent dataset and the BSD.

Matching to the BSD provided further complications due to the non-uniqueness of businesses in both datasets. The patent dataset has multiple observations for businesses that own more than one patent. Similarly, the BSD has multiple observations for the same business if it exists in more than one period. Both situations are very likely and would cause considerable problems if matched directly together. In such a situation, it is important to simplify the matching process. In this instance, the patent data were given a unique identifier (such as numbering the data from 1 to 35,000). Linking the enterprise references (and unique identifier) from the patent data to the business data (a relatively straightforward match) allowed a subsequent match; linking the business data to the patent data via the unique identifier. This process is straightforward and avoids the difficulty of sorting through multiple observations.

The IPO–BSD dataset

The matching of the two datasets was relatively successful; 93 per cent of IPO observations were matched (to some degree) with the BSD. The IPO data did not match for all points of reference: agent, applicant, and proprietor. **Table 2** presents the results in terms of matched and unmatched observations.

As stated previously, analysis should focus on proprietors as they are the beneficiaries of the patent, and because such analysis would be of use for policy purposes. Table 2 shows that about 40 per cent of proprietors matched to ONS data and are, therefore, useful for further analysis. The results indicate that, with possible improvements in the data from the IPO and investigation into bettering the name-matching algorithm, a greater success rate could be achieved. These results are very encouraging and indicate the possibility of further research to answer policy questions through matched data.

The characteristics of UK patenters

This section analyses the matched data to understand the characteristics of businesses patenting in the UK. Specifically, it tries to understand patenting activity with reference to business size. As stated above, the proprietor is the focus of analysis because this closely identifies the beneficiary of the patent.

This analysis does not exhaust the possibilities of the combined dataset, but demonstrates the detailed findings that can be produced. Generally, the relationship between business size and patenting activity attracts a lot of attention in policy circles.

Similarly, information on the location of patenting businesses is useful for regional economic and innovation policy. This article shows the potential of using the matched datasets to understand the location of patents and other related questions.

Size analysis

The innovation and patent literature highlights that patents are a good proxy for innovation (Helmers and Rogers, 2009). Therefore, to ask, what type of businesses patent to a greater degree? is tantamount to asking, does variation in business size explain variations in patenting habits (Balasubramanian and Sivadasm, 2008)? Consequently, a preliminary analysis of patent activity across different sizes of business could potentially reveal interesting patterns of patenter behaviour.

In this section, business size is based on UK audit regulations. The regulations state that there are three measures on which to determine the size of a business. This analysis will look at two of these, employment and turnover[9]. First, the patenting businesses are presented according to their size. This means that, if a business patents, the analysis focuses on the size of businesses irrespective of the number of patents they own. Subsequently, focus shifts to patents, explaining how many patents are filed by businesses of different sizes. Effectively, this analysis shows the size and the degree to which businesses of a given size patent.

Size analysis – size determined by number of employees

Figure 3 shows that most of the businesses in the database (about 55 per cent), are small in size from an employment perspective.

Despite the limited period covered within the dataset, Figure 3 shows that, over time, the proportion of small businesses that patent has increased and the proportion of large businesses has fallen. This is an interesting observation and further investigation to understand what has caused this change is needed. In addition, it would be useful to understand the resulting implications for patent and innovation policy.

Patent intensity is a more useful aspect to analyse because of its significance for patent and innovation policy. **Figure 4** depicts the patent intensity by business size analysis. Patent intensity analysis answers the question of 'what type of business owns the most patents?' Despite the presence of a high number of small businesses with patents, the lower number of large businesses account for, on average, a slightly greater proportion of total patenting. The most interesting aspect of this is that the proportion of patents held by medium-sized businesses is comparatively low, on average only 16 per cent of patents.

With additional matching, further analysis could be undertaken to investigate the difference between patenting and non-patenting businesses.

Size analysis – size determined by level of turnover

The number of employees in a business is a good proxy for size but may not be relevant to all sectors, especially in businesses where the production structure favours small numbers of employees, or economies of scale require a business to be large. To control for this effect, similar analysis has been undertaken using turnover as an indicator of a business size.

Turnover could be considered a better proxy for financial strength and business performance. **Figure 5** presents the percentages of businesses in each size category. There is only a slight difference in the number of businesses that have patents when comparing size based on turnover with size based on number of employees. The relative proportions of small, medium and large businesses are also similar, providing little extra insight. Therefore, it could be assumed that, businesses with fewer employees also have low turnover and qualify as small on both measures.

The patent intensity when turnover determines size differs from when size is determined by employment. **Figure 6** shows that large businesses have a higher patent intensity, on average 5 percentage points higher, when size is determined by turnover rather than employment. The intensity of patenting for small businesses is similar between the two determinants of size. Therefore, the proportion of patents held by medium-sized businesses is 5 percentage points lower when turnover, not employment, determines size.

The differences, though not major, show that the grouping of businesses for size analysis is sensitive to the criteria selected. Using more than one criterion is useful because it enriches conclusions and provides other analytical perspectives.

These results raise the question, what factors are responsible for the patenting intensity of small and large businesses? A complete explanation may include

Figure 3
Business size in the patent data

Source: Intellectual Property Office and Office for National Statistics

Figure 4
Patent activity by business size based on employment

Source: Intellectual Property Office and Office for National Statistics

Figure 5
Business size by turnover

Source: Intellectual Property Office and Office for National Statistics

Figure 6
Patent activity by business size based on turnover

Source: Intellectual Property Office and Office for National Statistics

other important factors such as business life, maturity, sector and the products of the business. Small businesses may be advantaged because of their flexibility and concentrated focus in a specific area. However, large businesses may have economies of scale that give them an advantage in creating and patenting. These suggestions are interesting, but further research is required to fully understand what determines the intensity of patenting.

Regional analysis

The regional dimension of patent activity is useful because it provides information for regional economic policy as well as innovation policy. Literature on innovation and patents argue that patents are a good predictor of innovation and therefore play a vital role in determining national and regional economic growth, company performance and the ability of businesses to compete internationally.[10] To understand this dimension, we have used patenter location from ONS data to observe patenting activity within the UK. Though the results are preliminary, they are indicative of regional trends in patenting.

The regions are classified according to a patenter's Nomenclature of Units for Territorial Statistics (NUTS) region. NUTS regions classify the UK territory based on government offices, groups of counties and groups of unitary authorities. Due to data limitations and disclosure restrictions, the analysis focuses on NUTS2 region (groups of counties).

Map 1 shows the average number of patents from 1999 to 2008, within NUTS2 regions. The map shows that the majority of patenting takes place in the South East of England. This could be due to the location of London. Interestingly there were also large numbers of patents in East Wales and Eastern Scotland which contain Cardiff and Edinburgh.

It is important to consider that this analysis reflects the location of the enterprise that patents, not necessarily the part of a business that innovates. This is due to the BSD containing the postcode for business, not necessarily the unit within the business that patents. For example if a business unit in Newcastle registers a patent but the enterprise who owns this unit is located in London, this analysis considers the patent to have been generated in London. Hence, there could be a head office bias that may be particularly prominent when considering capital cities.

The cluster of Berkshire, Buckinghamshire and Oxford is an interesting region because, at the NUTS2 level, it has (on average) the highest number of patents. This could be explained partially through its close proximity to London, business linkages and Oxford University. Likewise, the presence of Cambridge University might account for the considerable patenting activity in East Anglia. This preliminary analysis shows that further investigation will be useful to provide understanding for patenting trends and could contribute to evidence for policy formulation.

Patent renewal rate

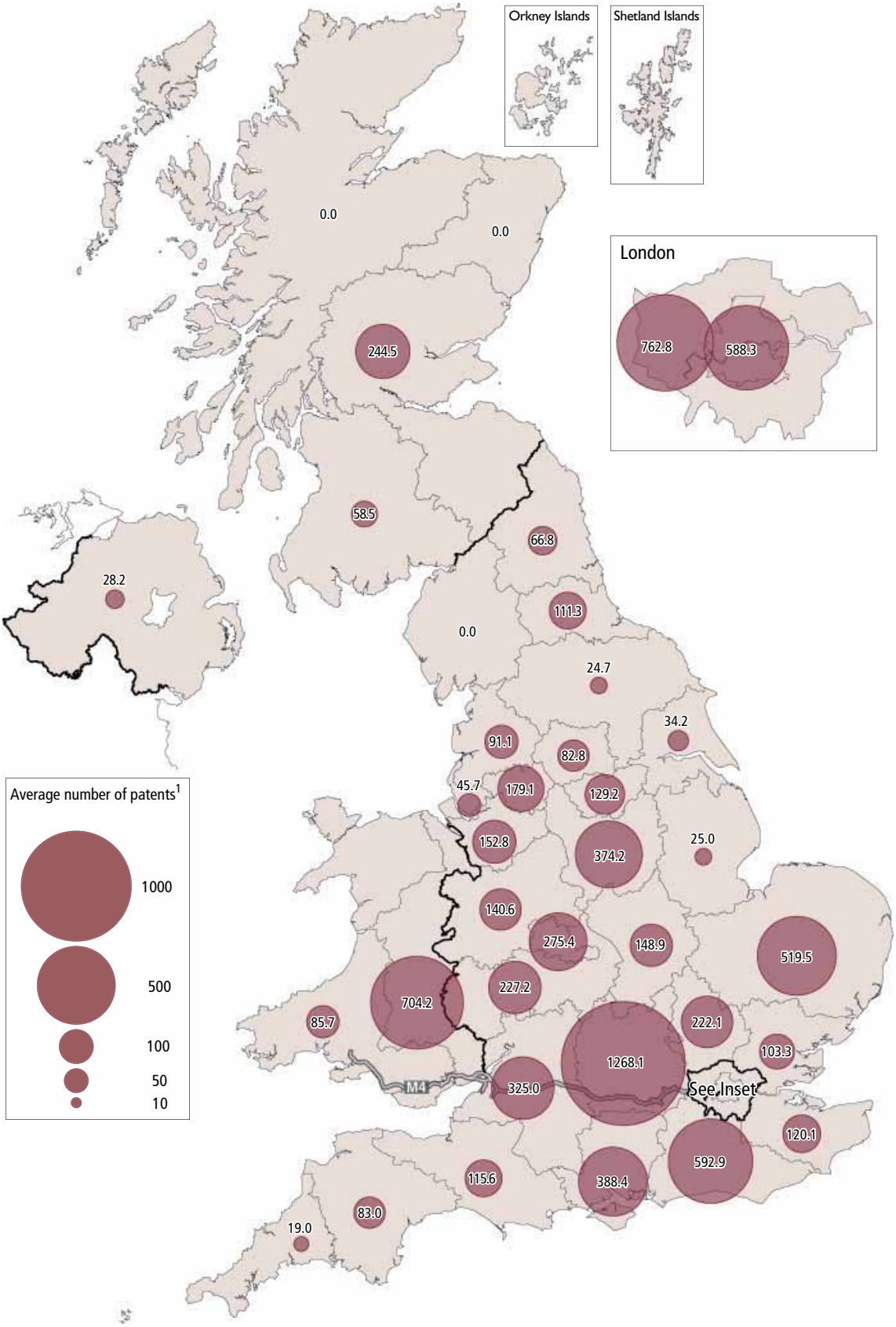
The rate of patent renewal is of particular interest to patent organisations around the world and has been a major point of discussion in literature (Van Zeebroeck, 2007, Pakes and Schankerman, 1984). It provides evidence on the life-length of innovation and the impact of renewal fee on the patent renewal rates. Furthermore, patent renewal rate is used to estimate research and development (R&D) and other intangible assets' life-lengths (Wenzel et al 2009). This section offers preliminary results on patent renewal rate at aggregate level.

The data covers nine years, from 2000–2008, therefore there are only four years after the 5 years of initial protection expires, that could provide evidence on the rate of patent renewal. This imposes a limitation on the results but still offers some insights.

It is important to point out that this section is particularly affected by patents such as divisionals and those applied for under the Patent Cooperation Treaty (PCT) that, within this dataset, have the filing/application date of the second patent/UK application date, rather than the filing/application date of the first patent/foreign application date. This affects the results as the renewal rate of patents may be under or overstated. While this hampers the usefulness and dependability of results, it does provide some indication regarding trends and the ability to undertake such analysis in future work.

Figure 7 shows the patent renewal rate in the total patent stock. This analysis treats each patent as a data point and then traces its life trajectory. After year five, when the patent renewal fee becomes due,

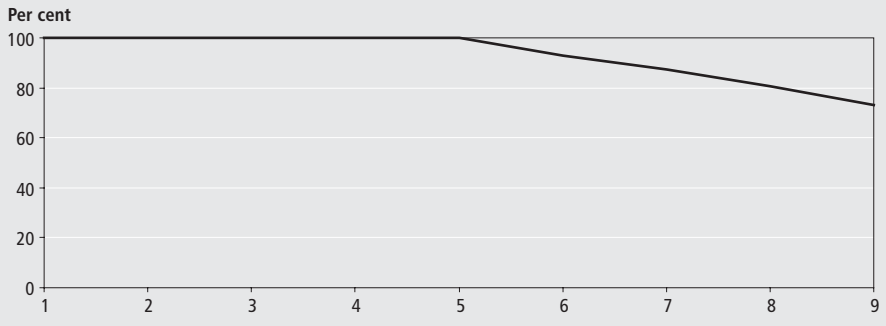
Map 1
Average number of patents by UK NUTS 2 area, 1999 to 2008



Note: *Source: Intellectual Property Office and Office for National Statistics*

1 The counts for Highlands and Islands, North Eastern Scotland and Cumbria are below the disclosure threshold of 10 businesses and are excluded from the map.

Figure 7
Renewal rate



Source: Intellectual Property Office and Office for National Statistics

the percentage of patents renewed steadily decreases. There are no dramatic changes in the renewal rate which falls steadily over time. Obviously, a longer time series would provide a better picture of the renewal pattern, but analysis across industries and businesses could also contribute to the understanding of variations in renewal rate. Subsequent work will focus on such cross-section analysis.

Matching to other business data registers

This article provides evidence that analysis on a patent/business dataset is practical and can provide insightful information. Such a dataset provides the opportunity for further matching to other ONS datasets. The resulting data could address specific policy questions on R&D and patenting, innovation and patents, and international trade of intangible assets and patents, among others.

Investigating the characteristics of businesses that patent is an important area for development, in order to understand why some businesses are more successful at patenting than others. This section provides a brief overview of some of the datasets that are being considered as part of a future plan for matching and analysis.

The Business Enterprise Research and Development (BERD) dataset covers expenditure on R&D activities. A match between IPO and BERD data could help to answer questions on links between R&D and patenting. R&D is likely to be the source of the vast majority of a business's patents. Therefore it would be of interest to analyse the effects of changes in R&D expenditure (for example, volume) upon the number of patents produced. This would not only examine the volume of patenting generated from R&D, but also provide evidence for the success rate of R&D and/or the perceived usefulness of innovative businesses patenting.

The International Transactions in Intangible Assets (ITIS) dataset provides information on the sale of various intangible assets, many of which would be protected by patents (particularly intangible assets such as R&D and computer services, among others). Analysis of this dataset could provide information on the value of patents to a business in terms of the sales generated of patentable products/services. Hence, this could provide a method of measuring the value of patents, an area of great interest to patent offices and academics alike.

The Annual Respondents Database (ARD) provides a comprehensive breakdown of information on business activity: expenditure on inputs, human resources, sales and so on. Matching this to IPO data can provide insight into the level of turnover or expenditure of patenters. This information could provide understanding of what differentiates patenting and non-patenting businesses, and what determines the intensity of patenting.

The Community Innovation Survey (CIS) focuses upon innovation within businesses. This survey includes questions on the importance placed on activities such as patenting and R&D, therefore providing primary evidence on the link between patenting and innovations. The CIS can provide information on patenting premiums, through the profitability of patenters compared to other innovative businesses, and how innovation is protected: through patenting or other strategic methods like secrecy contracts.

The analysis in this article has used business information obtained from the BSD. This dataset is not a spent resource. Perhaps the most notable piece of work that could be undertaken is an investigation into how the level of patenting is affected by the age of a business. Such an investigation is currently being undertaken in France where, among other things, it was discovered that patenting propensities depend on the age of a business (Lelarge, 2009; this paper is in preliminary stages and has yet to be published).

The use of such datasets, either individually or collectively, would provide a rich insight furthering current research into patenting and patenters. Various academics and international bodies are undertaking such research.

Conclusion

This article indicates that matching patent and business data can produce useful analysis that could meet the needs of patent and innovation policy makers. The current analysis is limited and considered preliminary; however, further investigation into data matching and types of analysis should be undertaken to improve the current dataset.

Developing matched databases is in the interest of patent organisations, national statistics institutes and policy makers in general. Patent organisations can gain a deeper knowledge of their customers' needs, which can feed into the patenting policy. This dataset allows access to a comprehensive patent-business dataset with the potential to be matched to many other ONS datasets, able to provide analysis on specific points of interests.

Comparing this dataset to currently created databases that match company data with patent data, offers an opportunity to compare businesses and companies and, if similar, the ability to use investigations on one particular dataset as a proxy for the other. Analysis of companies benefits from having a vast amount of company information, but does not consider all businesses. Analysis of businesses will consider all companies and businesses, and uses different business information.

The preliminary analysis in this article identifies that the majority of patent activity is undertaken by a small number of large-sized businesses and a large number of small-sized businesses. Furthermore, it would seem that UK patent activity occurs predominantly in the South East of England. The renewal rate of patents is consistent throughout the period for which information is held.

To conclude, this article clearly identifies a methodology for matching patent and business data. Such a match can be undertaken with the vast majority of observations matching in some form. Furthermore, such a dataset allows a detailed and varied analysis of patenters and patenting for UK-based businesses.

Notes

1. The dataset contained a few observations from 1998 but due to very low coverage of the 1998 patents we have dropped this year from matching.
2. Filing and application means essentially the same thing and we use these terms interchangeably. Filing is a preferred term in the IPO while the OECD Patent Statistics Manual uses application to describe the same process.
3. www.ipo.gov.uk/about/whatwedo/ourpublications/ourpublications-review.htm
4. The regional analysis used an average number of observations across the period; therefore the use of the incorrect application year should have little or no affect.
5. A handful of observations relating to patents applied for in 1998 were present within the dataset. The year 1998 was not included in analysis, but these patents were. Hence, this is why the first patent death occurs in 2003.
6. www.dnb.co.uk/about-dnb.asp
7. For more details on BSD see Evans and Welpton (2009).
8. If a particular patent had a point of reference, for example the proprietor, that was not a business or could not be matched to an enterprise reference number by the IDBR team, then this part of the patent data could not be matched to the BSD
9. Business size according to audit regulations:

	Small	Medium	Large
Employees	less than 50	51 to 250	Greater than 250
Turnover	£5.6 m	£5.61m to £22.8 m	Greater than £22.8m

The other measure of business size is gross assets, which is not attainable from this dataset.

10. Rosenberg (2004) specifies that technological innovation is a major force in economic growth.

CONTACT

elmr@ons.gov.uk

REFERENCES

Balasubrmanian, N. Sivadasan, J. (2008) 'What happens when businesses patent? New evidence from U.S. economic census data'. Center for Economic Studies, discussion paper January 2008.

Evans, P., Welpton, R. (2009) 'Methods explained: Business Structure Database' *Economic and Labour Market Review*, vol 3, no 6, pp 71–75.

Evans, P. Hatcher, M. Whittard, D (2008) 'The preliminary R&D satellite account for the UK: a sensitivity analysis' *Economic and Labour Market Review* 2 (9) pp37–43

Galido-Rueda, F. (2007) 'Developing a UK satellite account for UK: A preliminary analysis' Economic *and Labour Market Review* 1 (12) pp18–29

Helmers, C., Rogers, M. (2008) Innovation and the Survival of New Firms Across British Regions. University of Oxford, Department of Economics in its series *Economics Series Working Papers*, number 416

IPO (2009) 'Facts and Figures' at: www.ipo.gov.uk/about/whatwedo/ourpublications/ourpublications-review.htm

Lelarge, C (2009) 'The innovative activity of firms over their life cycle: Evidence from French mirco-data'. Paper presented at the Comparative Analysis of Enterprise Data (CAED) conference Tokyo, Japan, 3 October 2009, available at: http://gcoe.ier.hit-u.ac.jp/CAED/program.html, accessed 12 November 2009

Pakes, A. Schankerman, M (1984) 'The rules of obsolescence of patents, research gestation lags, and the private rate of return to research resources' in Zvi Griliches (ed.) *R&D, Patents and Productivity*, Chicago, University of Chicago Press, pp 73–88. British Library shelf mark 84/21211

Rosenberg, N (2004) 'Innovation and Economic Growth' at: www.oecd.org/dataoecd/55/49/34267902.pdf

Van Zeebroeck, N. (2007) 'Patents only live twice: a patent survival analysis in Europe' CEB Working Paper No 07/028 October 2007.

Wenzel, L. Khan, M.K.N. Evans, P (2009). 'Capitalising research and development: towards the new system of national accounts'. *Economic and Labour Market Review*, vol 3, no 9, pp 16–23.

ARTICLE

Changing costs of public services

Mike G Phelps
Office for National Statistics

SUMMARY

This article presents new estimates of how much the unit costs of public services, such as the NHS and schools, have changed compared to unit costs in general: the change in the relative cost of public service output.

Between 1997 and 2007, the unit cost of public service output in total grew by 13.7 per cent more than unit costs for the whole economy, an annual average relative rise of 1.3 per cent.

In 2007, the unit cost of public service output rose by 0.6 per cent less than costs in general, the only time relative costs fell over the 10 year period.

The relative cost of public service output changes as a result of a combination of two factors:

- changes in the price of inputs used in the public service, such as pay rates for people employed and prices paid for the goods and services used as inputs. The aggregate price index for these inputs rose by 9.8 per cent more than prices in general for the whole economy between 1997 and 2007, an annual average rise of 0.9 per cent
- changes in the efficiency and effectiveness with which resources are used to produce the output. In other words, there is a change in productivity. Between 1997 and 2007, public service productivity fell by 3.4 per cent, meaning that the volume of input needed to produce a unit of output rose by an annual average of 0.3 per cent

These are experimental statistics and work continues to develop the measures.

Introduction

ONS publishes articles on public service productivity. Productivity is one measure of the way resources are used to produce public services. The ONS approach, based on a National Accounts framework and recommendations in the Atkinson Review (Atkinson 2005), compares 'output' from public services with 'inputs', and takes change in the quality of output and input into account, though this is difficult to measure.

This article is the first to use a new, but linked, measure: relative unit cost of public service output.

The relative unit cost measure looks at how much the cost of a unit of public service output, such as health procedures performed or pupils taught, both adjusted for quality, has changed compared to prices in general.

The relative unit cost of public service output changes for two reasons. Firstly, there may be a change in the price of inputs used in the public service, such as pay rates or prices of drugs or school books used. For this article, these pay and price changes are considered relative to the change in prices throughout the economy. Secondly, there may be a change in the way resources are combined to produce the output, for example, fewer staff hours to produce the same result: this is a change in productivity. Both issues are important in helping understand the way national resources are used to produce public services.

The relationship is:

$$\text{Relative cost of output of public services} = \frac{\text{Relative price of input into public services}}{\text{Productivity}}$$

and is discussed in more detail in **Annex A**.

This article analyses changes in the relative unit cost of output of public services, using figures between 1997 and 2007, and shows the contributions to these changes from changes in the relative price of inputs into public services and from changes in productivity, for which figures were published previously as Total Public Service Output and Productivity (ONS 2009a).

The article is organised according to the following sections which aim to:

- summarise the estimates of relative unit cost of public service output
- outline the background to the article
- discuss cost per unit output of public services
- discuss input per unit output of public services
- discuss price per unit input of public services
- provide a comparison of components of relative unit cost of output of public services
- discuss the individual public service areas in detail
- provide a conclusion to the article

These are experimental statistics. ONS

welcomes feedback on this new approach and will aim to update figures annually.

Key messages

This article presents the first estimates of the relative unit cost of public service output, a new experimental measure related to public service productivity. It is a measure of how much the cost of a unit of public service output, such as health procedures performed or pupils taught, has changed compared to prices in general: the relative unit cost of public service output. **Figure 1** illustrates the cumulative change in relative unit cost since 1997.

Between 1997 and 2007 the key points to note are that:

- the volume of input needed to produce a unit of output grew by 3.5 per cent, an annual average rise of 0.3 per cent (this is the same as saying productivity fell by 0.3 per cent)
- the relative costs per unit of input grew by 9.8 per cent, an annual average rise of 0.9 per cent (this means input prices in the public services grew almost 1 per cent a year faster than prices in the whole economy)
- as a result of these effects, the relative cost of a unit of public service output grew by 13.7 per cent, an annual average rise of 1.3 per cent

Between 2006 and 2007:

- the index of the volume of inputs needed to produce a unit of output fell from 104.1 to 103.5 (a fall of 0.6 per cent, meaning that productivity rose)
- the index of the relative price per unit of input hardly changed, from 109.9 to 109.8
- the index of the relative cost of a unit of public service output fell from 114.4 to 113.7 (a fall of 0.6 per cent)

This contrasts with earlier years, when the relative unit cost of output rose. The rise in productivity in 2006 was insufficient to offset the rise in the relative price of inputs in that year.

Most of the rise in the relative unit costs of public service output comes from the rise in the relative price of inputs to public services, with a smaller fraction being explained by the fall in productivity.

This article also examines the changes in the relative unit cost of output, input per unit of output and relative price per unit of input by the major public service areas.

Key points to note are that:

- between 1997 and 2007 the relative unit cost of output did not fall in any public service
- in some service areas, notably healthcare, the relative unit cost of output fell in 2007

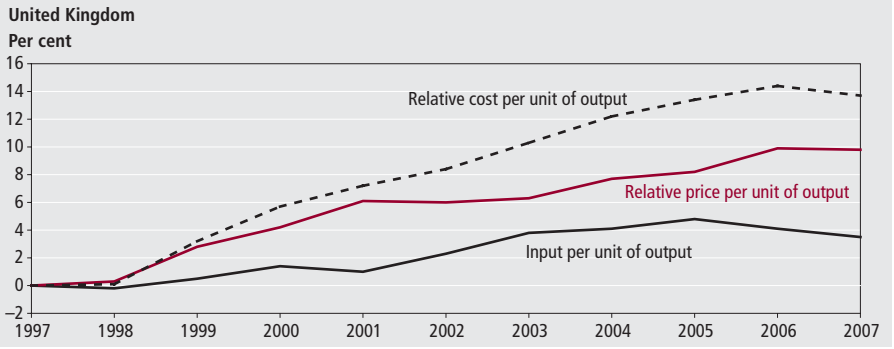
Labour costs grew faster in healthcare and education, where detailed information is more readily available, than in the wider economy in the later part of the period. This is shown in **Figures 2** and **3**.

The prices of the goods and services used as inputs into healthcare rose 10 per cent, less than home costs per unit of output[1] in the wider economy, which grew by 28 per cent as illustrated in **Figure 4**.

Background

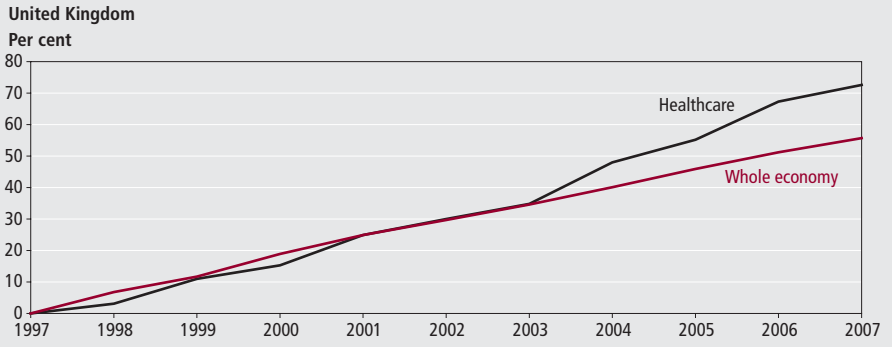
Public services are not normally traded in a market. In addition, units of output are not easy to define, so there is no

Figure 1
The change in total public service input per unit of output, relative price per unit of input and relative cost per unit of output, 1997–2007



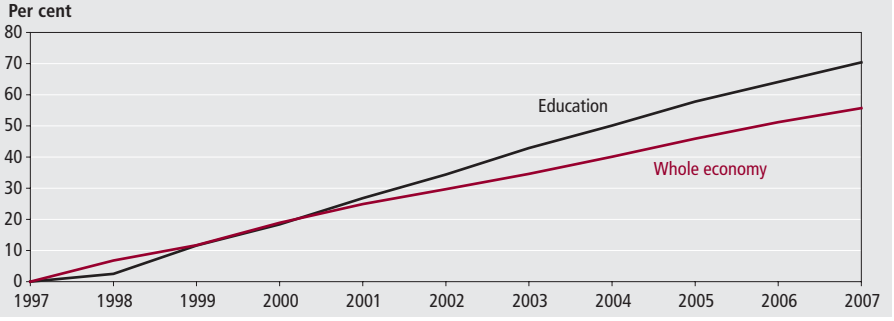
Source: Office for National Statistics

Figure 2
Cumulative change in labour costs in healthcare and whole economy, 1997–2007



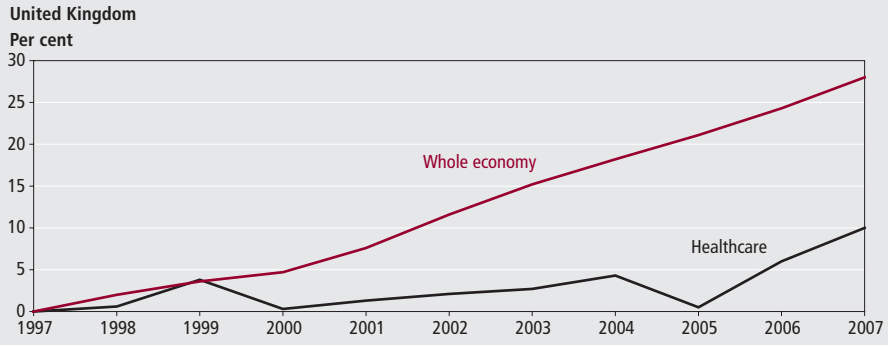
Source: Office for National Statistics

Figure 3
Cumulative change in labour costs in education and whole economy, 1997–2007



Source: Office for National Statistics

Figure 4
Cumulative change in goods and services costs in healthcare and whole economy, 1997–2007



Source: Office for National Statistics

straightforward measure of the price of a unit of public service output. Before 1998 it was usual to estimate public service output by assuming that the output was simply equal to the inputs used. However, since 1998 ONS has published estimates of the output of public services using direct activity measures for many services, such as health procedures performed and pupil hours experienced.

Approximately 65 per cent of General Government Final Consumption Expenditure (GGFCE) is now covered by direct activity measures. The remainder, mainly services provided collectively to everyone, such as defence, continue to be measured by the 'output=inputs' convention.

Once output is measured independently of inputs, it becomes possible to calculate measures of output per unit of input (productivity). ONS has published a series of articles, most recently, Total Public Service Output and Productivity (ONS 2009a) measuring change in productivity in public services. It also becomes possible to calculate the implicit price of public service output by dividing total expenditure on public services by the volume of output. This gives an estimate of a deflator for GGFCE, what taxpayers pay for a unit of government output – the (money) cost of public service output. Movements in this deflator give an estimate of inflation in the price of public services. Although this was noted in Understanding Government Output and Productivity (Pritchard 2003), little attention has so far been given to this measure.

The issue of greatest relevance to taxpayers and users of government services is how this measure of public service inflation compares with inflation in general. This comparison is of direct interest in showing whether the cost of a unit of public service output is rising in line with overall inflation. It also demonstrates how much of other goods and services are being given up to acquire the given levels of public service output. There are several indices of general prices that could be used for this comparison. The one chosen for this article is the index of total home costs per unit of output published in United Kingdom National Accounts Blue Book 2008 (ONS 2008), which reflects factors such as total labour costs per unit of output. This comparison gives an indication of what goods and services might have been produced if the resources devoted to public service provision had been devoted to producing goods and services in the same mix by the whole economy. See Annex A for some further technical notes on the method.

The relative cost of a unit of output can be broken down into two parts (see Annex A) to give some insight into what lies behind the overall movement in relative cost. The first part is the volume of input required to produce a unit of output; the second part is the relative price of the inputs used.

The rise in the index of overall input prices can, in principle, grow faster (or slower) than prices in general for three reasons. Firstly, the prices paid for inputs common to both the public and private sectors may grow faster (or slower) within public service procurement. Secondly, public services may use a different input mix, that is they may use, per unit of output, more (or less) than the economy-wide average of those inputs whose prices are increasing fastest. For example, if public services are labour intensive relative to the economy as a whole, and real wages are increasing (therefore money wages rise faster than prices in general), then there will be a tendency for the public service relative input price index to increase, even if real wages in public services grow at the same rate as real wages in the whole economy. Thirdly, the share of the input whose price is growing fastest may change at a different rate between public and private sectors.

In practice it is not possible to completely separate public and private sector input prices using current methods. This is because the volume of inputs of goods and services is (with some notable exceptions such as the use of drugs in healthcare) estimated by deflating the identified categories of expenditure by a price index based on what happens to prices in that category across the whole economy, not just in public services. In contrast, labour input in public services is often estimated directly, and therefore it is possible – using available figures for total labour costs in public services – to work out the relevant public service labour costs per unit of input. These can be compared with movements in labour costs in the wider economy. Comparing shares of expenditure on the different types of inputs between public services and the market sector is also not straightforward. Public services form part of final expenditure, Gross Domestic Product (Expenditure) (GDP(E)) whereas industry shares are in terms of Gross Domestic Product (Output) (GDP(O)) and value-added.

The following sections provide estimates of cost per unit of public service output, input per unit of public service output (the reciprocal of productivity) and price per unit of public service input.

Cost per unit of output

How has cost per unit of overall public service output changed?

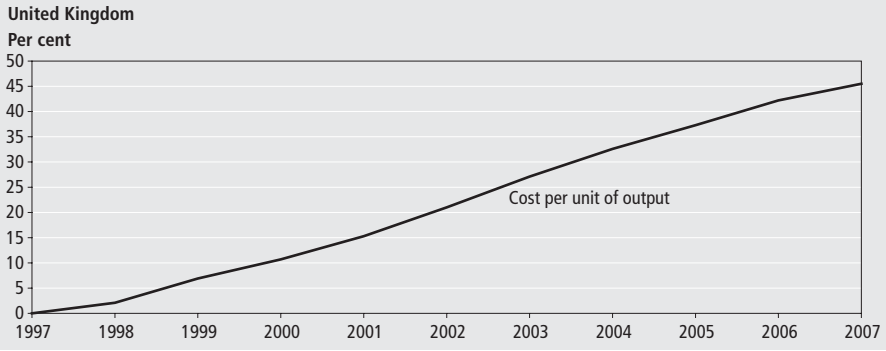
We first consider the money cost per unit of public service output, the GGFCE deflator implied by the output estimates headlined in Total Public Service Output and Productivity (ONS 2009a). This gives a measure of inflation for public service output.

Figure 5 illustrates how this cost has risen since 1997.

Between 1997 and 2007 the key points to note are that:

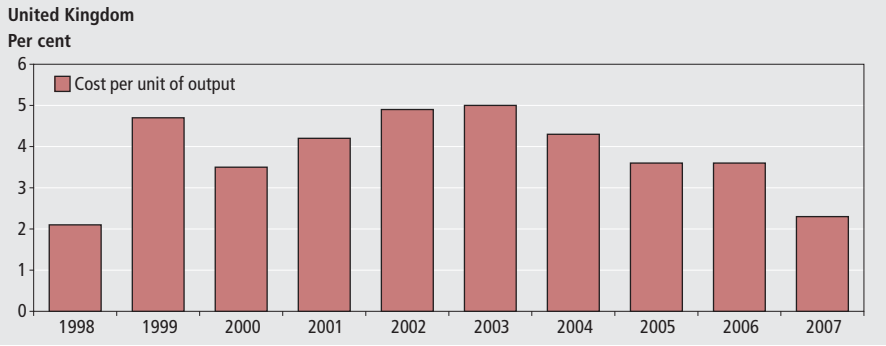
- the cost per unit of output of public services grew by 45.5 per cent, an annual average increase of 3.8 per cent
- the cost rose in every year

Figure 5
Cumulative change in total public service cost per unit of output, 1997–2007



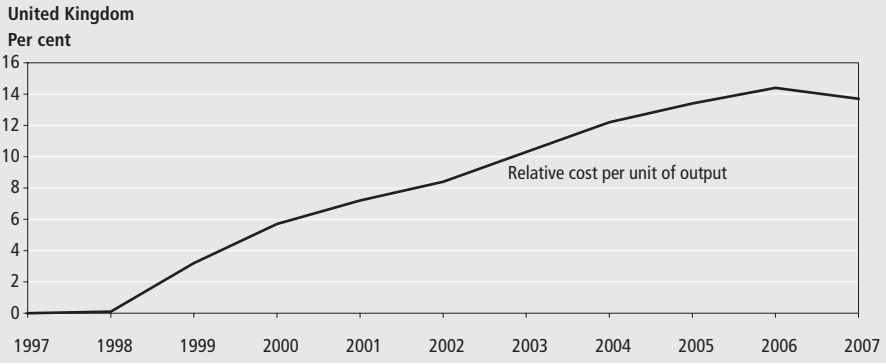
Source: Office for National Statistics

Figure 6
Growth in total public service cost per unit of output, 1998–2007



Source: Office for National Statistics

Figure 7
Cumulative change in relative unit cost of public service, 1997– 2007



Source: Office for National Statistics

Figure 6 illustrates how unit cost changed year by year.

Key points to note are that:

- the increase in unit cost rose from 2.1 per cent in 1998 to 4.7 per cent in 1999
- the cost rise then moderated in 2000, followed by a steady rise in cost growth to a peak of 5.0 per cent in 2003
- from 2003 unit cost growth fell, reaching a low of 2.3 per cent in 2007

Relative cost per unit output

A more meaningful measure than money costs alone can be found by comparing the cost of public service output with an index of overall prices. Candidate indices include:

- the GDP (Expenditure) deflator, which measures changes in the price of all final spending in the economy, and thus includes the prices of imports as well as consumption and investment
- home costs per unit of output, which measures the cost of producing output in the UK
- consumer price indices such as the Retail Prices Index or the Consumer Prices Index

The most appropriate index of overall prices depends on what question is being asked. Dividing by the GDP(E) deflator measures what the resources used in obtaining public services could buy if spent on exactly the mix of goods and services currently bought at whole economy level. Dividing by home costs per unit of output approximates what the resources used in public services could produce if they were used in exactly the same mix as is produced by the whole economy. Dividing by a consumer prices index gives the consumption foregone by the provision of public services. Neither the Retail Prices Index (RPI) nor the Consumer Prices Index (CPI) cover the whole of consumers' expenditure, nor are they constructed as deflators comparable in construction to the GDP(E) deflator.

The main body of this article uses home costs per unit of output. Comparing public service costs per unit of output with total home costs per unit of output gives an indication of what could have been produced if the resources used in public services had instead been used to produce a mix of goods and services as produced within the economy as a whole[2]. It provides a measure of opportunity cost in terms of overall output foregone.

Figure 7 illustrates public service unit costs relative to home costs per unit of output for public services as a whole, henceforth referred to as 'the relative unit cost of public services'.

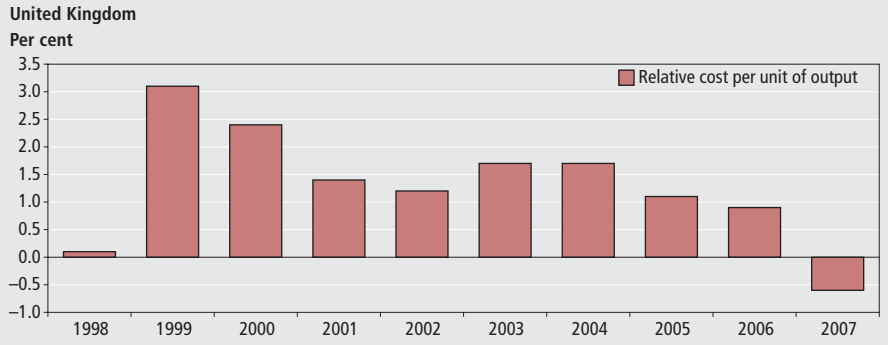
Between 1997 and 2007 the relative unit cost of public service output grew by 13.7 per cent, an annual average increase of 1.3 per cent. Of this 1.3 per cent, 0.3 percentage points, are explained by the rise in input per unit of output, and the remaining 1.0 percentage point by the rise in input prices in public services relative to the rise in home costs per unit of output.

Figure 8 gives the annual rates of change of the relative unit cost public services.

Key points to note are that:

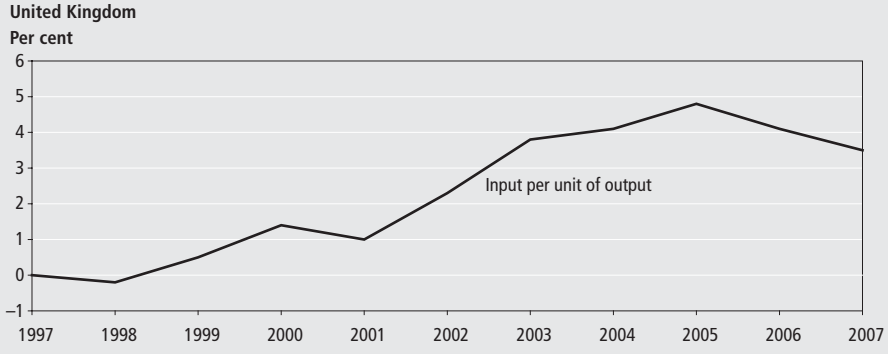
- the relative unit costs barely changed from 1997 to 1998
- the relative unit costs increased particularly fast in 1999 and 2000, by 3.1 and 2.4 per cent respectively
- the growth in relative unit cost fell to 1.2 per cent in 2002

Figure 8
Growth in total public service relative cost per unit of output, 1998–2007



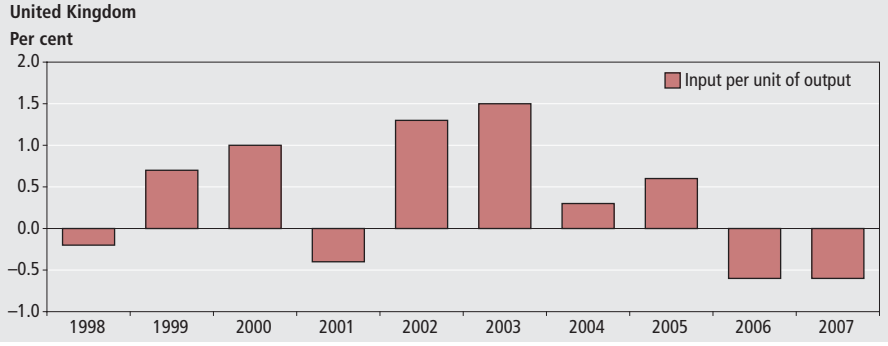
Source: Office for National Statistics

Figure 9
Cumulative change in total public service input per unit of output, 1997– 2007



Source: Office for National Statistics

Figure 10
Growth in total public service input per unit of output, 1998–2007



Source: Office for National Statistics

- the growth in relative unit cost rose again in 2003 to 1.7 per cent, where it remained in 2004
- after 2004 growth in relative unit cost slowed
- in 2007 the index fell by 0.6 per cent

Input per unit of output

How has overall input per unit of output changed?

This and the following sections outline the factors underlying the changes in relative cost of output. **Figure 9** illustrates the overall movement in input per unit of output for public services as a whole. This is the reciprocal of the estimates of productivity previously produced (ONS 2009a)

Between 1997 and 2007 the key points to note are that:

- input per unit of output grew by 3.5 per cent with annual average growth of 0.3 per cent
- the highest level of input per unit of output was reached in 2005, then it fell in 2006 and 2007

Figure 10 illustrates the annual rate of change of input per unit of output.

Key points to note are that:

- input per unit of output increased fastest (productivity fell) in the years 2002 and 2003
- in 2006 input per unit of output fell for the first time since 2001
- input per unit of output also fell in 2007, that is productivity rose in the last two years

Price per unit of input

How has price per unit of input into public service changed overall?

The other component of relative unit cost of output is the cost of the input required to produce it. This section considers this cost, that is an expenditure weighted average of the price indices for labour, goods and services and capital, used in public services. The first section considers movements in an index of money costs of inputs. The second section constructs an index of relative input costs, that is comparing movements in money costs with the movements in total home costs per unit of output in the wider economy.

Figure 11 illustrates (money) price per unit of input for total public service output[3].

Between 1997 and 2007 the key point to note is that:

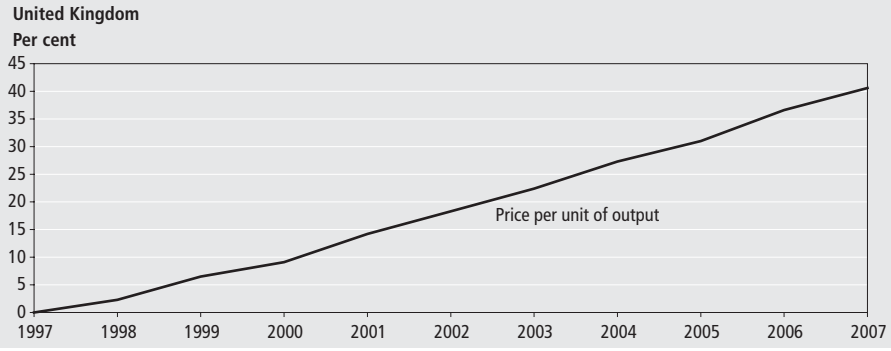
- the input price index increased by 40.6 per cent, an annual average increase of 3.5 per cent

Figure 12 illustrates the annual rate of change of input prices.

Key points to note are that:

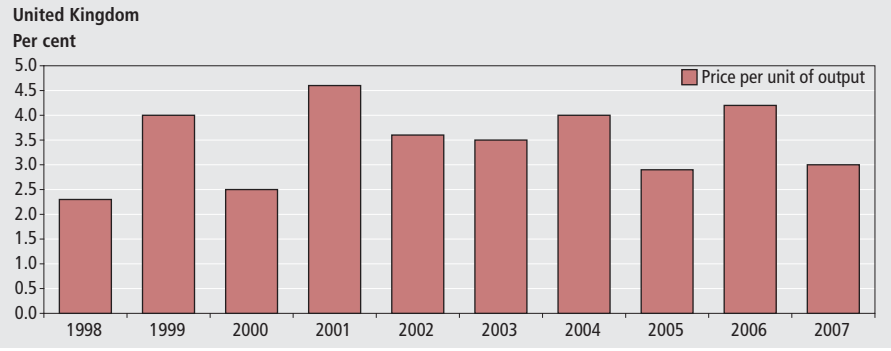
- the highest growth in input prices was in 2001, when they grew by 4.6 per cent
- in 2002 and 2003, input growth remained relatively high, at 3.6 and 3.5 per cent a year respectively, before rising again to 4.0 per cent in 2004
- although the growth weakened in 2005 to 2.9 per cent, it rose in 2006 to 4.2 per cent, the second highest growth rate within the period 1998 to 2007
- growth in input prices slowed to 3.0 per cent in 2007

Figure 11
Cumulative change in total public service price per unit of input, 1997–2007



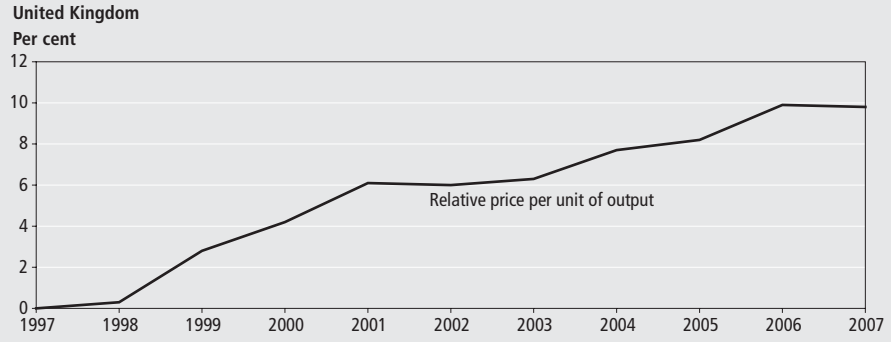
Source: Office for National Statistics

Figure 12
Growth in total public service price per unit of input, 1998–2007



Source: Office for National Statistics

Figure 13
Cumulative change in total public service relative price per unit of input, 1997–2007



Source: Office for National Statistics

How has price per unit of input risen in comparison to prices in general?

The previous section considered changes in actual prices. A comparison with price changes in general is needed to construct the component of relative unit cost of output.

Figure 13 therefore illustrates the relative price per unit of input, which compares the rise in the prices of inputs with the rise in prices in general, as measured by the index of total home costs per unit of output.

Between 1997 and 2007 the key point to note is that:

- the cost index increased by 9.8 per cent, an annual average increase of 0.9 per cent

In addition:

- relative input costs rose by almost six per cent between 1998 and 2001
- from 2001 to 2003 relative input prices changed little
- from 2003 to 2006 relative input prices rose, to 9.9 per cent above the 1997 level
- relative input costs fell very slightly in 2007

Comparison of components of relative cost of output

Figure 14 brings together the indices of change in the overall relative cost per unit of output and in its components, input per unit of output and the relative price per unit of input.

Between 1997 and 2007 the relative unit cost of public service output rose. The major part of this rise was due to the rise in the index of input prices. However the rise, over the whole period, in input requirements (that is, the fall in productivity) also made some contribution.

The relative unit cost of output fell in 2007. This arose from a fall in both relative input prices (that is, public service input prices rose less than home costs per unit of output) and in input requirements. The fall in input requirements (rise in productivity), however, was the dominant effect.

Individual public service areas

So far this article has only considered public services as a whole. This section initially examines unit cost, both absolute and relative, of public service by broadly classified 'Classification of the Functions of Government' (COFOG) and continues by examining the behaviour of the component parts of the relative unit cost index: input per unit of output and the relative price of inputs. This section concludes by looking at the two largest spending areas, healthcare and education, in more detail to see how the prices of the different kinds of inputs to health and education have been moving against relevant comparators.

How has cost per unit of output varied by service area?

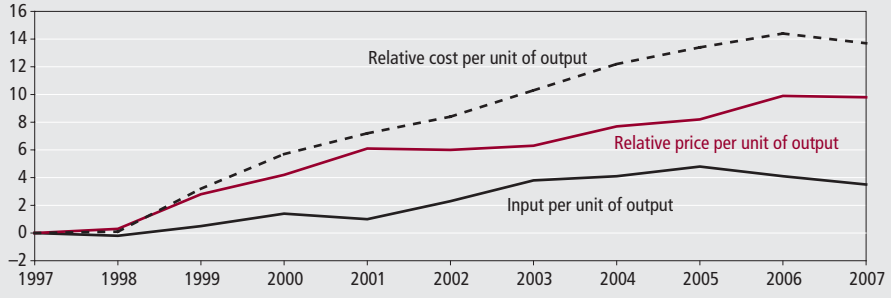
Table 1 summarises the index of cost per unit of output by service area[4].

Between 1997 and 2007 the key points to note are that:

- the annual average cost per unit of output increased the most in children's social care, 6.1 per cent
- public order and safety (POS) exhibited the second highest growth in annual average cost per unit of output at, 5.8 per cent

Figure 14
Change in total public service input per unit of output, relative price per unit of input and relative cost per unit of output, 1997–2007

United Kingdom
Per cent



Source: Office for National Statistics

- adult social care (ASC) exhibited an average growth in cost per unit of output of 5.5 per cent
- the average cost per unit of output of police was 4.9 per cent a year and in 'other' was 4.3 per cent[5]
- the average cost per unit of output of healthcare grew by 3.8 per cent, the same as the increase in unit costs for public services as a whole. The lower than public service average increase in input prices offset the somewhat higher than public service average increase in input per unit of output to give an average overall performance in terms of cost per unit of output
- the average cost per unit of output of defence rose by 2.5 per cent[5]
- social security administration (SSA) experienced the lowest increase in cost per unit of output of the directly measured services. The fall in input per unit of output, together with an only slightly above average rise in input costs, ensured that cost per unit of output growth was well below the average for all services

The large increases in relative unit costs in children's and adult social care and in public order and safety in part reflect the inadequacies of the output measures, which do not take proper account of quality (ONS 2009a).

Table 2 summarises public service unit costs relative to home costs per unit of output for each individual public service area

Between 1997 and 2007 key points to note are that:

- the absolute differences between services are the same as for the growth of (money) costs per unit of output
- all services, with the exception of defence, experienced a marked rise in relative unit cost

Table 1
Public service cost per unit of output by service area, 1997–2007

United Kingdom — Index (1997=100)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average annual percentage change
Healthcare	100.0	102.8	108.0	109.7	113.5	119.4	124.7	131.9	134.3	142.2	145.5	*3.8*
Education	100.0	100.8	104.2	109.6	118.7	128.4	135.1	141.6	147.6	153.8	159.2	*4.8*
Adult social care	100.0	103.0	111.7	119.9	125.4	131.2	144.5	148.2	158.7	165.4	170.1	*5.5*
Social security admin	100.0	98.1	111.4	124.0	116.9	118.0	149.6	145.7	171.5	133.2	129.2	*2.6*
Children social care	100.0	105.4	113.9	119.2	127.5	135.1	144.5	152.5	161.4	174.6	181.1	*6.1*
Public order & safety	100.0	106.2	125.1	139.5	136.8	143.3	150.8	168.3	173.8	175.0	175.4	*5.8*
Police	100.0	104.4	110.1	114.9	130.4	138.7	142.4	146.4	151.7	157.0	161.2	*4.9*
Defence	100.0	100.2	102.4	105.2	108.2	110.8	114.9	118.3	123.8	127.5	128.0	*2.5*
Other	100.0	102.6	107.4	111.7	116.7	123.2	130.4	136.4	143.0	149.7	152.9	*4.3*
Total	100.0	102.1	106.9	110.7	115.3	121.0	127.1	132.6	137.3	142.2	145.5	*3.8*

Source: Office for National Statistics

Table 2
Relative cost per unit of output by service area, 1997–2007

United Kingdom — Index (1997=100)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average annual percentage change
Healthcare	100.0	100.8	104.3	104.8	105.4	106.9	108.2	111.6	110.9	114.4	113.4	*1.3*
Education	100.0	98.8	100.6	104.6	110.3	115.0	117.3	119.8	121.9	123.8	124.4	*2.2*
Adult social care	100.0	101.0	107.9	114.5	116.5	117.5	125.5	125.4	131.0	133.1	132.9	*2.9*
Social security admin	100.0	96.2	107.5	118.5	108.7	105.7	129.9	123.3	141.7	107.2	100.9	*0.1*
Children social care	100.0	103.3	109.9	113.8	118.5	121.1	125.4	128.0	133.2	140.5	141.5	*3.5*
Public order & safety	100.0	104.2	120.7	133.3	127.1	128.4	130.9	142.4	143.5	140.8	137.1	*3.2*
Police	100.0	102.3	106.2	109.7	121.2	124.2	123.6	123.8	125.3	126.3	125.9	*2.3*
Defence	100.0	98.2	98.8	100.4	100.6	99.3	99.7	100.1	102.2	102.6	100.0	*0.0*
Other	100.0	100.6	103.7	106.7	108.4	110.4	113.2	115.4	118.1	120.4	119.5	*1.8*
Total	100.0	100.1	103.2	105.7	107.2	108.4	110.3	112.2	113.4	114.4	113.7	*1.3*

Source: Office for National Statistics

Table 3
Public service input per unit of output by service, 1997–2007

United Kingdom — Index (1997=100)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average annual percentage change
Healthcare	100.0	101.0	101.0	102.2	100.9	103.5	105.6	105.8	106.5	105.7	104.5	*0.4*
Education	100.0	98.2	96.4	96.5	98.3	100.1	100.6	102.2	103.3	103.8	104.5	*0.4*
Adult social care	100.0	98.4	102.4	103.6	104.3	104.8	109.6	106.0	107.1	106.6	104.5	*0.4*
Social security admin	100.0	93.1	102.0	110.1	99.8	98.3	119.5	112.2	118.6	97.4	90.7	*–1.0*
Children social care	100.0	101.7	106.6	106.9	110.5	113.6	117.6	118.8	120.3	127.0	126.4	*2.4*
Public order & safety	100.0	100.5	114.1	123.1	115.9	118.6	119.4	128.3	128.2	123.0	119.9	*1.8*
Police	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	*0.0*
Defence	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	*0.0*
Other	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	*0.0*
Total	100.0	99.8	100.5	101.4	101.0	102.3	103.8	104.1	104.8	104.1	103.5	*0.3*

Source: Office for National Statistics

Table 4
Relative price per unit of input by public service, 1997–2007

United Kingdom — Index (1997=100)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average annual percentage change
Healthcare	100.0	99.7	103.2	102.6	104.5	103.3	102.5	105.5	104.2	108.2	108.8	*0.8*
Education	100.0	100.6	104.3	108.4	112.2	114.9	116.6	117.3	118.0	119.2	119.1	*1.8*
Adult social care	100.0	102.6	105.3	110.5	111.7	112.2	114.5	118.3	122.3	124.8	127.2	*2.4*
Social security admin	100.0	103.3	105.4	107.6	109.0	107.5	108.7	109.9	119.4	110.0	111.3	*1.1*
Children social care	100.0	101.6	103.1	106.5	107.3	106.6	106.7	108.5	110.8	110.6	111.9	*1.1*
Public order & safety	100.0	103.6	105.8	108.2	109.7	108.3	109.7	111.0	111.9	114.5	114.3	*1.3*
Police	100.0	102.3	106.2	109.7	121.2	124.2	123.6	123.8	125.3	126.3	125.9	*2.3*
Defence	100.0	98.2	98.8	100.4	100.6	99.3	99.7	100.1	102.2	102.6	100.0	*0.0*
Other	100.0	100.6	103.7	106.7	108.4	110.4	113.2	115.4	118.1	120.4	119.5	*1.8*
Total	100.0	100.3	102.8	104.2	106.1	106.0	106.3	107.7	108.2	109.9	109.8	*0.9*

Source: Office for National Statistics

- the rise in children's social care (CSC) was the highest
- healthcare experienced the average rise for public services as a whole
- only defence and SSA had increases in relative unit cost below the public service average
- the relative unit cost of SSA rose by only 0.1 per cent a year and relative unit costs in defence were virtually unchanged – that is, a unit of output cost the same in terms of output foregone in 2007 as in 1997

How has input per unit of output moved in different services?

Input per unit of output (the reciprocal of productivity) has not moved uniformly across all public services. **Table 3** illustrates growth in input per unit of output by individual service between 1997 and 2007.

Between 1997 and 2007 the input per unit of output in:

- CSC grew fastest, by 26.4 per cent overall, an annual average increase of 2.4 per cent
- POS grew by 19.9 per cent, an annual average growth of 1.8 per cent, the second fastest growth
- ASC grew by 4.5 per cent, an annual average growth of 0.4 per cent
- healthcare grew by 4.5 per cent, an annual average growth of 0.4 per cent
- education grew by 4.5 per cent, an annul average growth of 0.4 per cent
- SSA fell by 9.3 per cent, an annual average fall of 1.0 per cent (SSA was the only service where input per unit of output fell)

The remaining services, police, defence and 'other', provide services collectively for everyone rather than directly to individuals. Here, following international guidance, output is assumed to be equal to inputs. So input per unit of output is unchanged by assumption.

Due to the absence of quality adjustments, the estimates of input per unit of output of CSC and POS may be too high since the productivity growth is underestimated (ONS 2009a).

How has relative price per unit of input varied by service?

Table 4 summarises the relative price per unit of input by individual public service.

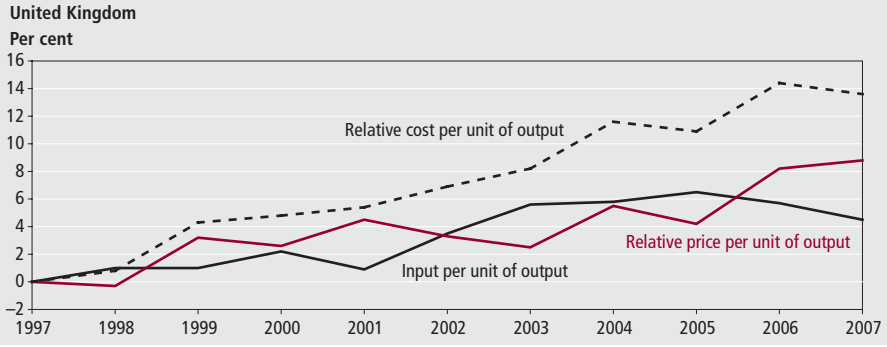
Between 1997 and 2007 the relative price per unit input:

- grew above the average annual rate of 0.9 per cent in every sector except healthcare, where relative input prices grew by 0.8 per cent and defence, where relative input prices were unchanged
- increased the most in adult social care, where relative input prices grew by 27.2 per cent, an annual average of 2.4 per cent

More detailed discussion of major service areas

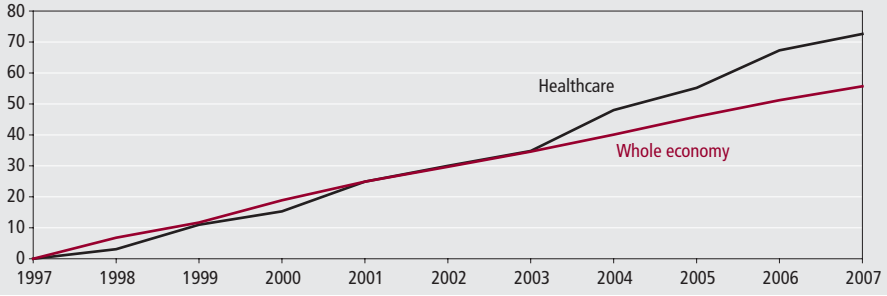
The following sections discuss the two largest spending areas, healthcare and education, in more detail. For these two services it has been possible to investigate what lies behind the input prices, in particular, in more depth. Future articles will extend this type of analysis to other public service areas.

Figure 15
Cumulative change in healthcare input per unit of output, relative price per unit of input and relative cost per unit of output estimates, 1997–2007



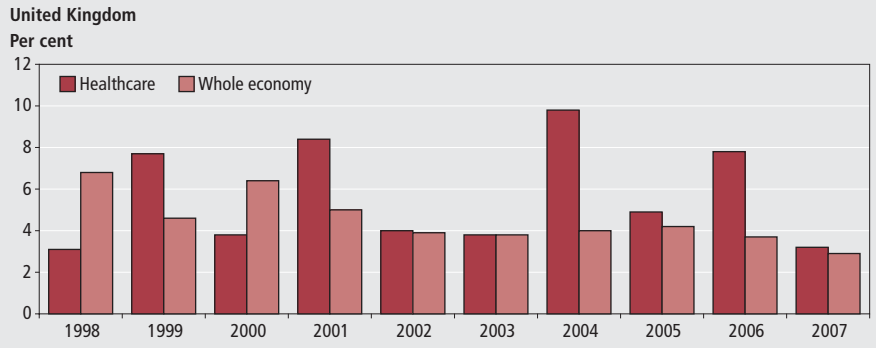
Source: Office for National Statistics

Figure 16
Cumulative change in labour costs in healthcare and whole economy, 1997–2007



Source: Office for National Statistics

Figure 17
Growth rates of labour costs for healthcare and whole economy, 1998–2007



Source: Office for National Statistics

Healthcare

Healthcare accounts for approximately 30 per cent of total government spending on public services, the largest individual spending area. **Figure 15** brings together the main comparisons for healthcare.

Between 1997 and 2007 key points to note are that:

- the relative costs per unit of output rose by 13.6 per cent, an annual average increase of 1.3 per cent
- relative input prices rose by 8.8 per cent, an annual average increase of 0.8 per cent
- input per unit of output rose by 4.5 per cent, an annual average increase of 0.4 per cent (equivalent to a fall in productivity of 0.4 per cent)
- relative unit costs rose in every year except 2005 and 2007
- in 2005 the fall in the input price index outweighed the slight rise in the index of input per unit of output
- in 2007 the opposite effect occurred, the fall in input requirements more than offset the rise in input prices
- between 2001 and 2003 the fall in input prices was offset by increasing input requirements, so relative unit costs rose

Although the relative input price index for healthcare rose over the whole period, implying that input prices increased faster than whole economy costs per unit of output, the rise in relative input prices in healthcare was below the rise in relative input prices for public services as a whole.

It is possible to investigate the reasons for rising relative healthcare input prices in more detail, by looking at the rise in the component parts of the healthcare input price index.

The shares of expenditure on these broad input categories of labour costs, costs of the inputs of goods and services and capital costs[6] are summarised in **Table 5**.

Expenditure shares of each component do not change substantially over the period. The largest component of healthcare expenditure is labour, followed by goods and services, with capital being notably smaller. Using the theoretically more appropriate measure of capital services would raise the share of capital a little, as it also includes a real rental element, but this effect would not be large. So attention below is concentrated on labour and goods and services.

The prices of these component parts of the index can be compared with measures of relevant economy-wide prices or costs.

Figure 16 illustrates the index of labour costs in healthcare compared with the index of total compensation of employees per hour for the whole economy. Note that for both series, labour costs are not the same as current wage costs, as they include, for example, pension and other contributions.

Key points to note are that:

- labour costs in healthcare have risen faster than those in the whole economy, with most of the divergence occurring after 2003
- between 2001 and 2003 the index of healthcare labour costs was approximately at the same level as whole economy labour costs
- from 2004 to 2007 labour costs in

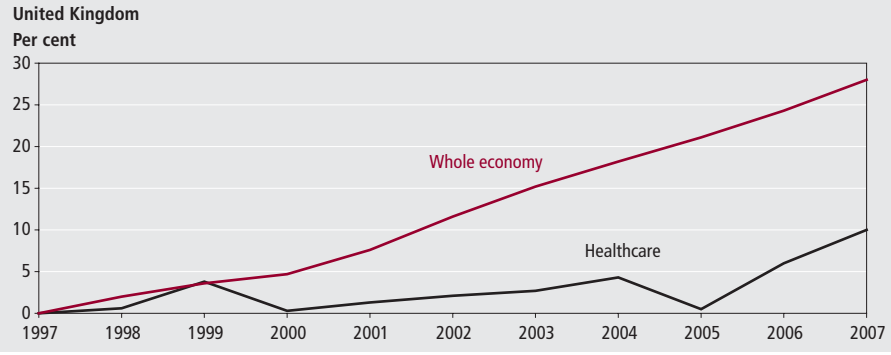
Table 5
The expenditure share of each component of healthcare, 1997–2007

United Kingdom Per cent

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Labour	*51.6*	*50.6*	*51.4*	*51.6*	*53.2*	*53.0*	*52.5*	*54.5*	*55.3*	*54.5*	*53.6*
Goods and services	*45.2*	*46.3*	*45.7*	*45.4*	*44.2*	*44.5*	*44.9*	*43.3*	*42.5*	*43.4*	*44.4*
Capital	*3.2*	*3.1*	*2.8*	*3.0*	*2.7*	*2.6*	*2.6*	*2.2*	*2.2*	*2.1*	*2.0*
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

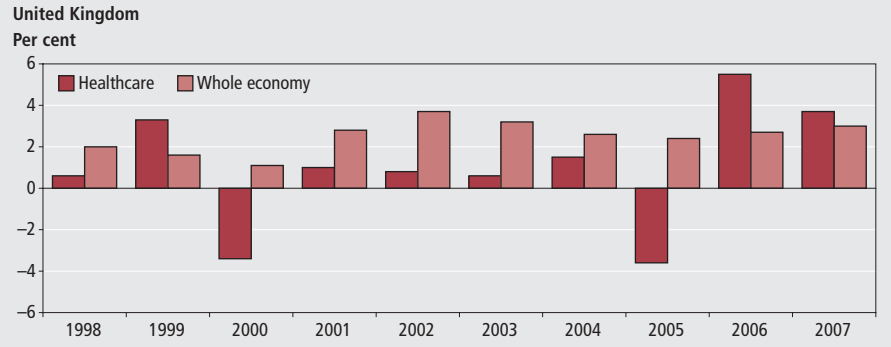
Source: Office for National Statistics

Figure 18
Cumulative change in goods and services costs in healthcare and whole economy, 1997–2007



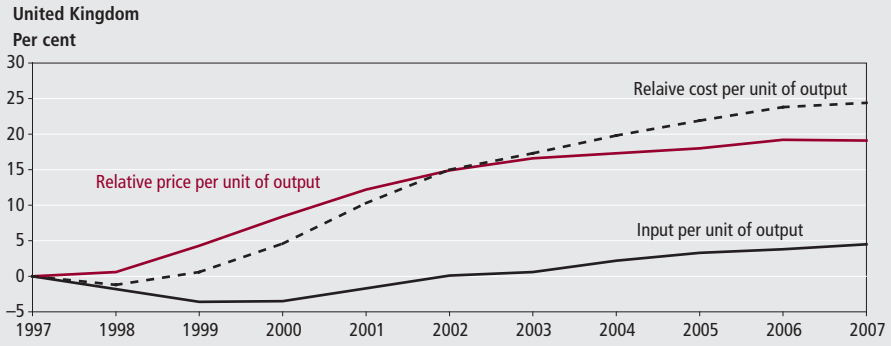
Source: Office for National Statistics

Figure 19
Growth rates of goods and services costs for healthcare and whole economy, 1998–2007



Source: Office for National Statistics

Figure 20
Cumulative change in education input per unit of output, relative price per unit of input and relative cost per unit of output estimates, 1997–2007



Source: Office for National Statistics

healthcare increased relative to labour costs in the economy as a whole (especially in 2004 and 2006). The result was that the healthcare index in 2007 stood 72.6 per cent above its 1997 level, whereas the whole economy index only stood 55.7 per cent above the 1997 level

Since labour costs account for over half of total healthcare input costs, the rise in labour costs within healthcare account for a substantial part of the rise in overall relative price of inputs. This is partly explained by new contractual arrangements, which were intended to encourage recruitment, improve incentives and reduce what were thought to be excessive hours worked in some parts of healthcare, hence improving quality of care. Some of the ways in which quality might improve may not be adequately accounted for by the quality adjustments made to derive output estimates.

Figure 17 illustrates the year-by-year movement of labour costs in both healthcare and the whole economy.

Healthcare labour costs grew more slowly than whole economy labour costs in 1998 and 2000, but rose faster in 1999 and 2001. As a result, in 2001 the index of healthcare labour costs and the whole economy labour costs were at the same level. In 2002 and 2003 the growth of labour costs in healthcare was the same as that in the economy as a whole. From 2004 to 2007 labour costs in healthcare increased relative to labour costs in the economy as a whole (especially in 2004 and 2006).

It is possible to compare labour costs within publicly funded healthcare directly with labour costs in the wider economy. However, it is not possible at present to make an analogous comparison for goods and services used in healthcare. This is because the estimates of the volume of inputs are generally made simply by deflating expenditure by appropriate whole economy price indices. The exception to this is drugs used as inputs that, like labour, are directly measured. However, it

Table 6
The expenditure share of each component of education, 1997–2007

United Kingdom Per cent

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Labour	*69.6*	*69.3*	*68.9*	*68.6*	*69.3*	*70.2*	*68.7*	*68.6*	*68.5*	*68.7*	*68.3*
Goods and services	*22.9*	*21.8*	*22.0*	*23.5*	*23.0*	*21.9*	*22.8*	*23.1*	*24.0*	*24.9*	*25.5*
Capital	*7.5*	*8.9*	*9.1*	*7.8*	*7.8*	*7.9*	*8.5*	*8.3*	*7.5*	*6.4*	*6.2*
Total	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Source: Office for National Statistics

is possible to compare the healthcare goods and service price index with an economy-wide index of costs. This comparison shows how far the different input mix in healthcare has led to a different increase in price indices.

Figure 18 illustrates how the prices of goods and services used as inputs in healthcare have risen, compared to the total rise in home costs per unit of output.

Between 1997 and 2007 the prices of goods and services used in healthcare rose by 10.0 per cent, whereas home costs per unit of output rose by 28.0 per cent over the same period. It is this low rise in input prices that is responsible for the relatively low rise in total input prices compared to other public services. Switching from branded to generic drugs may have played a major role in keeping input price growth low.

Restrained growth in the price of goods and services inputs in healthcare has to some extent offset the relatively high recent growth in labour costs. The overall result is that relative overall input costs in healthcare have risen more slowly than input costs in most other public services. However, because of healthcare's large weight in total public services, this translates into healthcare having the same increase in input costs as the public service (weighted) average.

Figure 19 illustrates the year-by-year movement of goods and service costs in healthcare and compares them with home costs per unit of output for the whole economy.

Key points to note are that:

- the growth in healthcare goods and services input price was below whole economy input price growth in all years, except 1999, 2006 and 2007
- in 2000 and 2005 prices of goods and services in healthcare fell despite positive input price growth in the whole economy

Education

The other area where it has been possible to investigate a little further is education, which accounts for approximately 19 per cent of total public service spending. **Figure 20** brings together the main comparisons for education.

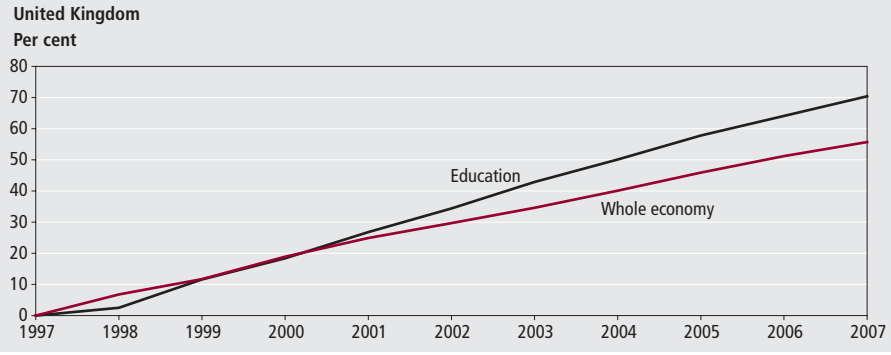
Between 1997 and 2007 key points to note are that:

- relative cost per unit of output rose by 24.4 per cent, an annual average increase of 2.2 per cent
- input per unit of output rose by 4.5 per cent, an annual average increase of 0.4 per cent (equivalent to a fall in productivity of 0.4 per cent)
- relative input prices rose by 19.1 per cent, an annual average increase of 1.8 per cent
- relative cost per unit of output rose in every year since 1998
- relative input prices increased every year until 2007, when they fell slightly
- between 1997 and 1999 input requirements fell, but increased in every year thereafter (that is, productivity fell from 1999 onwards)

Table 6 illustrates the expenditure shares of the broad components of education spending.

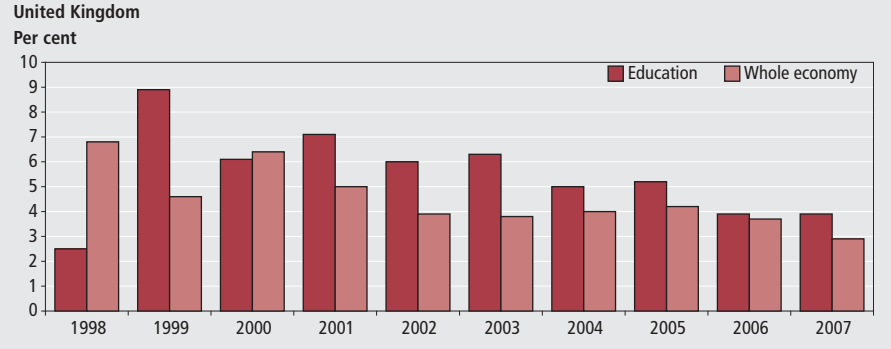
Labour is by far the largest component, accounting for over two-thirds of spending in every year. Goods and services account for between one-fifth and one-quarter of the total and are the second largest component. Capital, which for education is measured by capital services, is the smallest component.

Figure 21
Cumulative change in labour costs in education and whole economy, 1997–2007



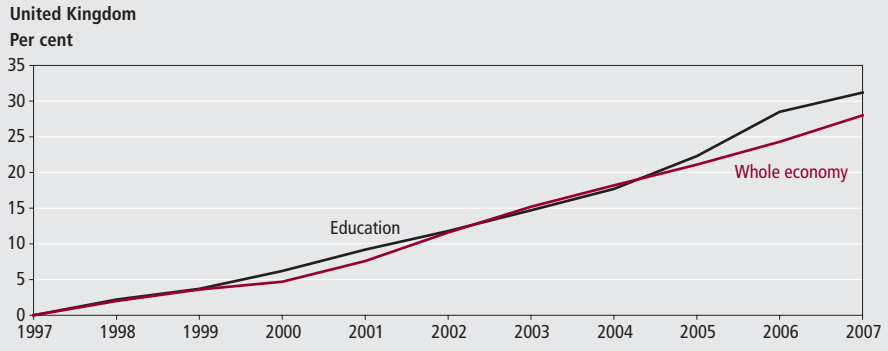
Source: Office for National Statistics

Figure 22
The annual growth rates of labour costs for education and whole economy, 1998–2007



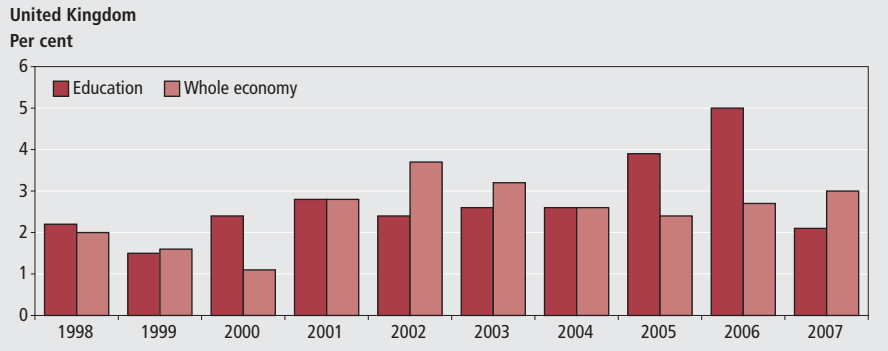
Source: Office for National Statistics

Figure 23
Cumulative change in goods and services costs in education and whole economy, 1997–2007



Source: Office for National Statistics

Figure 24
Growth rates of goods and services costs for education and whole economy, 1998–2007



Source: Office for National Statistics

The prices of the component parts of the index can be compared with measures of relevant economy-wide prices or costs. As with healthcare, it was not thought worthwhile to compare the relatively small and volatile capital measure.

Figure 21 shows the index of labour costs in education compared with an index of total labour costs per hour for the whole economy.

Between 1997 and 2007 key points to note are that:

- in 1998 labour costs in education grew slower than in the whole economy
- in 1999 and 2000 the index of labour costs in education had recovered to be almost identical to the whole economy index
- from 2001 labour costs in education stood consistently above the whole economy index

Annual changes for labour costs are illustrated in **Figure 22**.

Labour costs in education grew faster than in the whole economy in every year except 1998, as already noted, and marginally in 2000.

Education is labour intensive, hence, the rise in relative unit costs in education are probably due to:

- labour costs per employee rising faster than prices in general
- labour costs per employee in education rising faster than in the whole economy

Some part of the explanation of the rise in labour costs lies in a deliberate policy to improve recruitment to teaching with the aim of increasing the skills of the workforce. Insofar as the policy is successful, the quality of education should improve. However, the existing quality measure in the output of education depends only on GCSE results, so the full effects of any quality improvement would take time to be recorded.

Figure 23 compares the weighted change in the economy-wide prices of those inputs used in education, such as stationery, with an overall economy-wide index of costs.

The indices differ only due to the differences in input mix, though a small gap opens up from 2003 onwards.

Figure 24 illustrates the annual growth rates of goods and services costs in both education and whole economy between 1997 and 2007.

Key points to note are that:

- the goods and service price index for education grew at a noticeably greater rate than those in the whole economy in 2005 and 2006
- the goods and service price index for education grew at the same rate as those in the whole economy in 2001 and 2004
- in 2007 the annual growth rate in the goods and service price index for education was less than that of the whole economy.

Conclusion

This article has presented estimates of an experimental measure that shows how the cost of a unit of public services has been moving relative to the unit cost of total output. It has shown that public service unit costs have risen because input requirements have increased and the price of inputs has risen relative to unit costs in general. It is the rise in relative input price indices which explains the larger part of the rise in relative output unit costs.

It has not so far been possible to break down the movement in the aggregate price indices into that part explained by public services paying more for the individual inputs and that part explained by public services using relatively more of those inputs growing fastest in price. However, more detailed investigation of healthcare and education suggests that, at least in these areas, the rise in input price indices reflect to some degree faster increases in labour costs than in the wider economy.

Further work will investigate in more detail movements in each sector of the public services.

Notes

1. Home costs per unit of output provide an estimate of the cost of producing output across the whole economy within the UK.
2. It includes a proportion of public services. It could be argued that it would be better to use a deflator which covered everything except the cost of public services. Further work will investigate the practicability of such a measure.
3. Previously published (ONS 2009a).
4. The categories healthcare, education, adult social care, children's social

care and public order & safety are all covered by direct activity measures. In the remaining services, changes in the volume of output continue to be measured by the 'output=inputs' convention. The category referred to in this article as 'other' brings together many smaller spending areas including general public services, economic affairs, environmental protection, housing and community amenities and recreation, culture & religion.

5. This is the same as for prices per unit of input (since input per unit of output is constant by assumption).
6. For healthcare capital costs are given by capital consumption rather than the theoretically more appropriate measure of capital services.
7. So in the main body of the article, P is the index of total home costs per unit of output.

CONTACT

elmr@ons.gov.uk

REFERENCES

Atkinson T (2005) *Atkinson Review: Final Report: Measurement of Government Output and Productivity for the National Accounts,* Palgrave Macmillan: Basingstoke.

ONS (2008) *United Kingdom National Accounts Blue Book 2008*, available at: www.statistics.gov.uk/downloads/theme_economy/BB08.pdf

ONS (2009a) *Total Public Service Output and Productivity,* available at: www.statistics.gov.uk/articles/nojournal/TotalPublicServiceFinalv5.pdf

ONS (2009b) *Quality-Adjusted Labour Input (experimental),* available at: www.statistics.gov.uk/statbase/product.asp?vlnk=14206

ONS (2009c) *Capital Services (experimental),* available at: www.statistics.gov.uk/statbase/Product.asp?vlnk=14205

Pritchard A (2003) *Understanding Government Output and Productivity,* available at: www.statistics.gov.uk/articles/nojournal/GovOutput&Productivity.pdf

ANNEX A

Methodology overview

This section summarises formally the methodology underlying this article.

The implicit price index for public service output can be found by dividing total expenditure on public service output by the index of total public service output. Let this price index be P_t^p where t is the relevant year. This index is implicit in the calculations of direct output measures already published by ONS, but has not been published since Pritchard (2003). We also denote the corresponding quantity and price indices for inputs as Q_t^i and P, both of which were previously published in *Total Public Service Productivity*.

As there is no profit income in the public sector, the value of inputs is equal to total spending on public services (that is, the value of output). That is:

$$Q_t^p P_t^p = Q_t^i P_t^i \text{ or } P_t^p = \frac{Q_t^i}{Q_t^p} P_t^i$$

The ratio Q_t^i / Q_t^p may be described as the index of the amount of input required to produce a unit of output. For the analysis below, we denote this index as I_t. It is obvious from its form that it is simply the reciprocal of the already published productivity index.

The index of the breakdown of the cost in pounds of public service output can be written as

$$P_t^p = I_t \, . \, P_t^i$$

And the index of costs relative to prices in general can be written as

$$P_t^p / P_t = I_t \, . \, P_t^i / P_t$$

where P_t is an appropriate index of prices in general[7].

The movement of this index over time is given by the expression

$$\frac{P_1^p}{P_0^p}\frac{P_0}{P_1} = \frac{I_1}{I_0}\frac{P_1^i}{P_0^i}\frac{P_0}{P_1}$$

The body of the paper reports results for the relative unit cost of public service output, $\frac{P_1^p}{P_0^p}\frac{P_0}{P_1}$, and also for the relative cost of public service inputs, $\frac{P_1^i}{P_0^i}\frac{P_0}{P_1}$. The index $\frac{I_1}{I_0}$ is simply the reciprocal of the standard productivity movement between year 0 and year 1.

The main text calculates the cost of a unit of public service output relative to total home costs per unit of output. Other comparisons are possible. For example, public service inflation could be compared with a measure of the prices of goods and services making up personal consumption. This would give an indication of how much real consumption was being given up to acquire the given level of public service.

The volume of input required to produce a unit of output is the reciprocal of the productivity measures which have already been published in Total Public Service Output and Productivity.

The relative price of the inputs used is given by an appropriate expenditure-weighted index of the input prices, estimates of which were also published in Total Public Service Output and Productivity, divided by the index of home costs per unit of output. The product of the index of input per unit of output and the index of relative price per unit of input is an index of the relative unit cost of public service output.

The index of the cost of a unit of public service output is a measure which depends only on the estimates of public service output and total expenditure on public services. It does not depend on the price of inputs or on productivity. If input price growth is over-estimated the consequence is that the volume of input growth will be under-estimated hence, productivity growth over-estimated. Errors in estimates of input prices lead to offsetting errors in estimates of input per unit of output, leaving the relative unit cost of public service estimate unchanged.

ANNEX B

Growth rates

This section summarises the percentage change at an annual rate of each of the major component tables of this article such that the growth rates between any two periods of each component can easily be identified.

For example, in **Table B1** an entry in any cell shows the annual growth rate from the initial year, given by the cell row and the end year, given by the cell column. For example, the coloured figure (0.8) in Table B1 shows the annual growth rate in input per unit of output between the years 2000 (the initial year) and 2003 (the terminal year).

The entries in the bottom of each column show the growth in any year compared to the previous year. The entries along the top row show how annualised growth changes as the end year is updated, for a fixed start year of 1997. The entries in the last column show how annualised growth rates change, as the start year is updated from 1997, for a fixed final year of 2007.

Table B1
Growth in input per unit output, 1997–2007

United Kingdom — Percentage change, at annual rate

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1997	–0.2	0.2	0.5	0.3	0.5	0.6	0.6	0.6	0.5	0.3
1998		0.7	0.8	0.4	0.6	0.8	0.7	0.7	0.5	0.4
1999			1.0	0.3	0.6	0.8	0.7	0.7	0.5	0.4
2000				–0.4	0.4	0.8	0.7	0.7	0.4	0.3
2001					1.3	1.4	1.0	0.9	0.6	0.4
2002						1.5	0.9	0.8	0.5	0.2
2003							0.3	0.5	0.1	–0.1
2004								0.6	0.0	–0.2
2005									–0.6	–0.6
2006										–0.6

Source: Office for National Statistics

Table B2
Growth in relative price per unit input, 1997–2007

United Kingdom — Percentage change, at annual rate

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1997	0.3	0.2	1.4	1.5	1.2	1.0	1.1	1.0	1.0	0.9
1998		2.4	1.9	1.9	1.4	1.2	1.2	1.1	1.1	1.0
1999			1.4	1.6	1.0	0.8	0.9	0.9	1.0	0.8
2000				1.8	0.9	0.7	0.8	0.7	0.9	0.8
2001					–0.1	0.1	0.5	0.5	0.7	0.6
2002						0.2	0.8	0.7	0.9	0.7
2003							1.3	0.9	1.1	0.8
2004								0.5	1.0	0.7
2005									1.5	0.8
2006										0.0

Source: Office for National Statistics

Table B3
Growth in cost per unit output, 1997–2007

United Kingdom — Percentage change, at annual rate

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1997	*2.1*	*0.2*	*3.4*	*3.6*	*3.9*	*4.1*	*4.1*	*4.0*	*4.0*	*3.8*
1998		*4.7*	*4.1*	*4.1*	*4.3*	*4.5*	*4.4*	*4.3*	*4.2*	*4.0*
1999			*3.5*	*3.8*	*4.2*	*4.4*	*4.4*	*4.3*	*4.2*	*3.9*
2000				*4.2*	*4.6*	*4.7*	*4.6*	*4.4*	*4.3*	*4.0*
2001					*4.9*	*5.0*	*4.8*	*4.5*	*4.3*	*4.0*
2002						*5.0*	*4.7*	*4.3*	*4.1*	*3.8*
2003							*4.3*	*3.9*	*3.8*	*3.4*
2004								*3.6*	*3.6*	*3.2*
2005									*3.6*	*3.0*
2006										*2.3*

Source: Office for National Statistics

Table B4
Growth in relative cost per unit output, 1997–2007

United Kingdom — Percentage change, at annual rate

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1997	*0.1*	*0.2*	*1.9*	*1.7*	*1.6*	*1.6*	*1.7*	*1.6*	*1.5*	*1.3*
1998		*3.1*	*2.8*	*2.3*	*2.0*	*2.0*	*1.9*	*1.8*	*1.7*	*1.4*
1999			*2.4*	*1.9*	*1.7*	*1.7*	*1.7*	*1.6*	*1.5*	*1.2*
2000				*1.4*	*1.3*	*1.4*	*1.5*	*1.4*	*1.3*	*1.0*
2001					*1.2*	*1.4*	*1.5*	*1.4*	*1.3*	*1.0*
2002						*1.7*	*1.7*	*1.5*	*1.3*	*0.9*
2003							*1.7*	*1.4*	*1.2*	*0.8*
2004								*1.1*	*1.0*	*0.5*
2005									*0.9*	*0.1*
2006										*–0.6*

Source: Office for National Statistics

ARTICLE

Understanding the quality of early estimates of Gross Domestic Product

Gary Brown, Tullio Buccellato, Graeme Chamberlin, Sumit Dey-Chowdhury and Robin Youll
Office for National Statistics

SUMMARY

There has been considerable attention paid in recent months to Office for National Statistics early estimates of Gross Domestic Product (GDP). These estimates provide a timely indication of the evolution of the economic cycle, and there has been particular interest in their reliability, given the potential for the estimates to be revised.

This article describes the context in which the official estimates of GDP are produced, and examines the reason for revisions to early estimates. It goes on to discuss how these revisions can best be analysed over different maturities of the estimates and points out some potential pitfalls. Based on this discussion, it offers guidance on the best approach to understanding the revisions cycle and for interpreting the published information on revisions.

The article then presents the results of analysis of a new real time database for GDP growth in the UK, which contains a time series of estimates back to 1961. Over the period since the mid-1990s, revisions have been much smaller than previously, perhaps reflecting the relative stability of the economy over this time.

The article concludes by discussing the issues surrounding the use of bias adjustments for GDP.

The first estimate of GDP

Timely statistics relating to the growth of real GDP (that is GDP after adjusting for changes in prices) are needed by users so that their decisions better reflect current economic circumstances. ONS's preliminary GDP Statistical Bulletin is designed to meet this need. The release is published just 25 days after the reference quarter, making it the fastest official estimate of its type produced by any major industrialised country. The timeliness of this release is consistent with longstanding demand from users for quickly available information to support analysis in relation to economic policy.

The preliminary estimate of GDP is based on information requested from nearly 40,000 businesses relating to their turnover in the first two months of the relevant quarter. The remaining month includes data from a further 20,000 returns. In addition, each month ONS collects prices on nearly 200,000 individual products from around 30,000 retail and other businesses. This information is used to adjust the estimates of GDP into 'real terms', that is by removing the effect of inflation.

However, at the time this first estimate of GDP is produced, these data cover only about 40 per cent of the economic activity which will be included in the more mature estimates published around 12 months later. The remainder of the early estimate is based largely on forecast models. As time progresses, the data content of the GDP estimates increases, reducing the need to forecast. As data from annual surveys and administrative data become available, ONS uses Supply and Use analysis to reconcile fully the three different measures of GDP, based on the Output, Income and Expenditure approaches. These annual estimates form a benchmark against which the quarterly estimates are aligned. This leads to further revision of the estimates. Also, new sources and methods better to measure the evolving economy are introduced periodically. These, too, can lead to revisions to the estimates. As these methodological developments are open-ended, in principle GDP could be revised in perpetuity. In that sense, there is no such thing as a final estimate of GDP. See Mainwaring *et al* 2007.

This process of updating estimates as more information becomes available, and the consequent revision of the earlier estimates, means that there is a necessary and explicit trade-off between the timeliness and reliability of the early estimates. In 2004, the then Monetary Policy Committee (MPC) member, Marian Bell commented

> 'The Monetary Policy Committee recognises that revisions are inevitable. Indeed so far as they bring us to a better understanding of reality, we welcome them.' She continued 'There is inevitably a trade-off between timeliness and accuracy, but in general, we would prefer early imperfect data to late perfect series – it gives us something to work with.'

Later that year, Rachel Lomax, the then

Deputy Governor of the Bank of England said

> 'If the ONS waited two or three years before publishing their first estimates they would have reasonably complete information. But it would be of rather limited use for policy purposes.
> We need more timely indicators of economic activity, even though these will tend to be less accurate than later estimates.'

Even though there is a general understanding of why revisions occur, they still present a challenge to policy-makers in forming their current assessment of the economy. A key question is how much weight should be placed on the early estimates if they continue to be revised, often for several years afterwards. This is especially pertinent when policy is set pro-actively, such as monetary policy. The Bank of England has referred to this as 'dealing with data uncertainty' (see Ashley *et al* 2005).

The next section describes how ONS reports these revisions and how this enables users to understand better the quality of the early estimates and makes explicit the trade-off made between timeliness and reliability.

How ONS reports information on revisions

As part of the commitment to improving the quality of economic statistics, ONS monitors and publishes extensive information on revisions. This is part of its open policy towards revisions which includes incorporating, quickly and transparently, new information into the published estimates, as it arrives. Revisions information is published in Statistical Bulletins, in on-line spreadsheets and in an annual article in the *Economic and Labour Market Review* (see, for example, Murphy 2009). These practices are amongst the most transparent in the world.

The availability of information on revisions helps users understand the evolution of the quality of the estimates. Seen in this way, revisions should not be considered as necessarily errors, but rather as part of the process by which economic statistics are produced.

For analytical purposes it is convenient to store information on revisions to GDP in the form of 'revisions triangles', or real-time databases as they are sometimes known. **Box 1** describes how these data are arranged and their importance in the analysis for revisions. The key point here is that the triangles present revisions for different 'maturities' of GDP. The first published estimate of growth in real GDP for a period is said to be of maturity 1 (a M1 estimate). When this is updated the following month, it has maturity 2 (a M2 estimate). Revisions calculated between estimates of different maturities (say between M1 and M3) ensure that the estimates are of the same 'age', this is they have all had the same length of time to mature. For example, in the case of a comparison of M1 an M3 estimates, all estimates have had 2 months to mature. An average of revisions with the same age can then be calculated which provides an expected revision between different maturities of the estimates based on the historical data.

Through analysis of the revisions triangles, it is possible to look for patterns in revisions and, in particular, to assess whether there might be a dominant

Box 1

ONS revisions triangles (or real time databases) of GDP

ONS makes available on its website information about revisions to key economic statistics, including GDP. This includes so called 'revisions triangles' which are published in the form of spreadsheets, and allow users to develop their own analysis of the revisions history of GDP. The spreadsheets also contain some summary statistics of the revisions.

These databases present revisions to GDP in the format of a 'triangle' of published estimates, as shown schematically in Table 1.

Table 1 The ONS revisions triangle

Release date	Estimate for:				
(or 'vintage')	…	2007 Q4	2008 Q1	2008 Q2	2008 Q3
…	…	…			
March 2008	…	M3			
April 2008	…	M4	M1		
May 2008	…	M5	M2		
June 2008	…	M6	M3		
July 2008	…	M7	M4	M1	
August 2008	…	M8	M5	M2	…
…	…	…	…	…	…

The table shows, for example, that the first estimate of GDP growth for the first quarter of 2008 (2008Q1) was published in the April 2008 preliminary GDP Statistical Bulletin. This is referred to as the M1 (or month 1) 'maturity'. The second estimate of the *same growth rate* for 2008Q1 was published in May 2008 in the Output Income and Expenditure Statistical Bulletin, referred to as the M2 (or month 2) maturity.

The point about the revisions triangles is that they show how each estimate of GDP 'evolves' over time as more information becomes available. They therefore provide a history of each estimate as a series of maturities (M1, M2, M3 etc).

To understand the data presented in the triangles, it is important to distinguish between three different aspects of the data:

- the **Period** is the quarter to which any given estimates relates, that is there are a series of different estimates for the period 2008Q1, starting with the M1 estimate published in April 2008
- the **Maturity** can be thought of as the 'age' of a given estimate, for example the M1 estimates represent the estimates of age 1 month (that is the first published estimates for any period). Similarly, estimates of maturity 3 (M3 estimates) are three months old
- the **Vintage** is a given release of data at a given point in time. It is the temporary state of the quarterly GDP time series composed of estimates which all have different maturities

The difference between maturities for any particular estimate (say between the M1 and M3 maturities) is the revision to that estimate between those two maturities. Presented in this way, that is as a set of differences, the triangles show how estimates of GDP have been revised. This allows the calculation of an average, or expected revisions between different maturities.

direction in the revisions process (which would indicate a bias in early estimates). ONS carries out extensive analysis of this type, as part of its quality assurance process, to help avoid unnecessary revisions in future estimates.

The next section considers how this published information can be used to develop understanding of the revisions process.

Interpreting and analysing information on revisions

Revisions to estimates of the growth of the volume of GDP arise for a variety of reasons. These include:

- as late responses received from businesses in ONS sample surveys are incorporated into the estimates;
- from regular and planned updates to the structures used to compile aggregates (such as updating of the gross value added weights based on annual surveys);
- one-off methodological improvements – for instance, the introduction of annual chain-linking, and changes in the national accounting framework.

Occasionally, there will also be revisions to GDP arising from the correction of errors and mistakes. But such cases are very rare.

ONS monitors the impact of each type of revision as a standard part of the compilation of estimates of GDP. (See Mainwaring *et al* 2007 and Youll 2008.) It is important as part of this monitoring to distinguish between routine revisions, which arise from the regular updating of the estimates, and those which arise from changes to methodology.

During the routine revisions cycle, which consists broadly of the period from the preliminary (that is M1) estimate to the estimate published 24 months later (M24), revisions usually arise from incorporating late data, updating the seasonal adjustment, and from benchmarking of the quarterly estimates of GDP to more complete annual data sources. Beyond 24 months, revisions are more generally caused by changes to methodology, including changes to the international national accounting standards under which GDP is compiled.

The important point here is that these later methodological changes effectively 'move the goalposts' in that they represent fundamental changes in the basis of measurement. Accordingly, any comparison of the first estimates with those made 4 or 5 years later has to be made with great care. Any such comparison will include the effects of the specific methodological improvements made over that particular period. No doubt, future methodological improvements will also be made, but their effects will depend on their specific nature. The underlying point is that information about past revisions incorporating the effects of methodological change can not be used reliably to anticipate the likelihood or extent to which the current estimates of GDP will be revised over a similar sort of timescale.

In an ideal world, it would be helpful to know, with a high degree of certainty, what such future changes in methodology might be, and to predict in advance their likely effect in generating revisions to the current estimates of GDP. In reality, this is plainly not possible. Many of the methodological improvements to constructing GDP introduced in the UK in the last 10 years, for example, represent the outcome of years of methodological research and development around the world.

The measurement of the economy faces similar challenges to other scientific disciplines, where the current state of development is used as the basis of measurement in the full knowledge that this will improve as research continues. GDP measurement faces the additional challenge that the economy itself evolves, and so the tools needed for its measurement also need to keep up with those changes.

As a practical example, the latest estimate of real GDP growth for 2003Q1 incorporates the effects of a number of significant methodological changes which were not incorporated in the preliminary estimate when it was published in April 2003. These include chain-linking of the estimates, the addition of estimates of 'own account' software, an improved approach to the measurement of Financial Intermediation Services Indirectly Measured (FISIM), and a series of improvements to the measurement of government output, following the recommendations of the Atkinson Review.

All of these developments have given rise to revisions. In principle, ONS could avoid any revisions arising from methodological improvements by placing a permanent embargo on such changes. But that would scarcely be a sensible policy.

It is important to be aware of the potential for future revisions arising from methodological improvements. However, for the reasons discussed, comparative analysis that fails to allow for their effects can lead to fallacious and misleading conclusions. For practical purposes, consideration of revisions due to non-methodological causes is likely to give a sounder basis for assessing the quality of early estimates.

Normally, the bulk of revisions from non-methodological causes (that is incorporation of late and benchmark data) are taken on within 24 months of the first estimate being published. It is over this timeframe, therefore, that analysis of revisions is likely to be of most value in assessing the quality of the early estimates.

The next section, and much of the remainder of this article, examines the quality of early estimates of GDP based on analysis of a new long-run database of revisions.

A new long period database of GDP revisions

As noted earlier, revisions triangles are collections of different maturities of GDP estimates which show the actual estimates of real GDP growth available to users at specific points in time.

Hitherto, ONS has published website revisions triangles for GDP going back to 1993 (see www.statistics.gov.uk/statbase/Product.asp?vlnk=13560). However, this is a fairly limited sample and for most of this period, the UK economy was unusually stable, by historical standards. To overcome these limitations, ONS has built a revisions triangle for real GDP growth estimates for a much longer period, back to 1961. This information will now be published on the website.

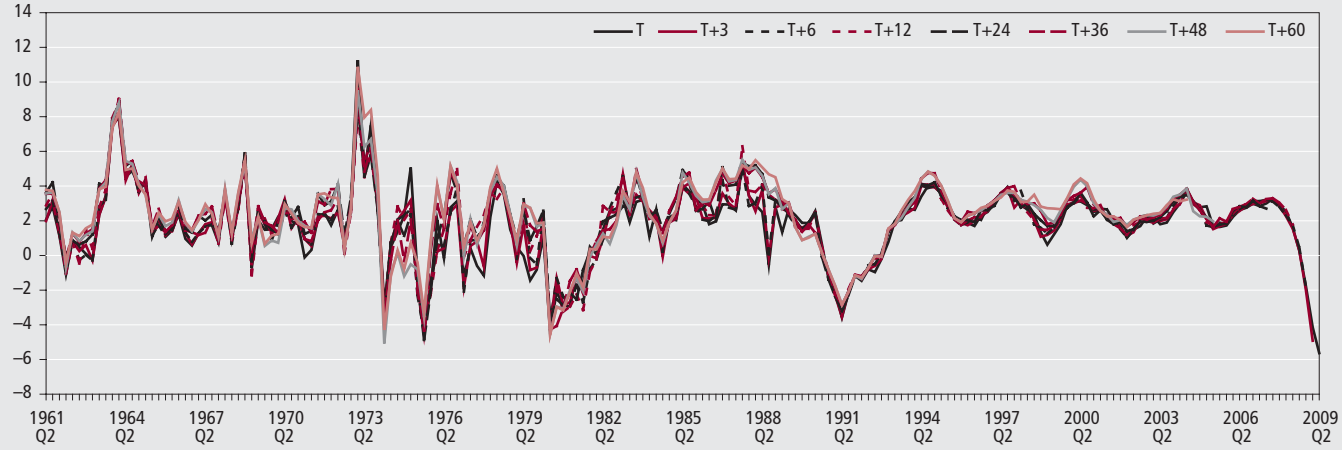
The first GDP estimate in these triangles pertains to 1961Q2 and the last to 2009Q2. Data have been collected for the expenditure measure of GDP, so the triangles should be similar to the real time database constructed by Castle and Ellis (2002). The new triangles differ from the revisions triangles ONS has published previously, in that the different GDP maturities relate to successive monthly journal publications and not to estimates published in Statistical Bulletins (that is Preliminary Estimate; Output, Income and Expenditure, Quarterly National Accounts and Blue Book). But because the underlying data are the same, any differences will be small.

Features of the long-run real-time GDP dataset

Figure 1 presents eight different maturities of GDP growth between 1961Q2 and 2009Q2. These are the first published estimate (T) for each quarter, and then the respective

Figure 1
Real time GDP data

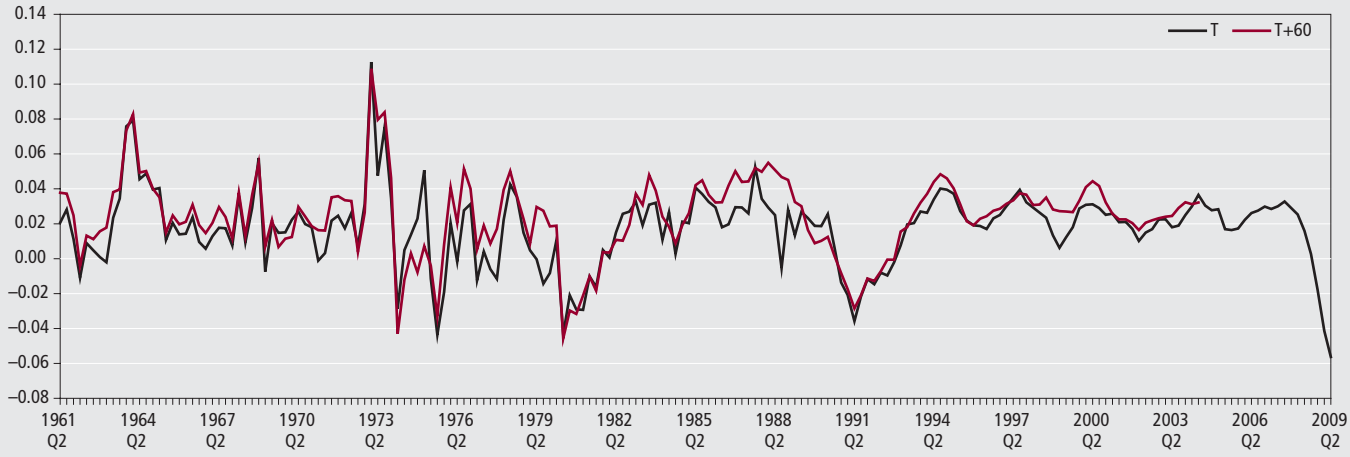
Percentage growth, quarter on same quarter 1 year ago



Source: Economic Trends and Economic & Labour Market Review

Figure 2
Real time GDP data, T and T+60

Percentage growth, quarter on same quarter 1 year ago



Source: Economic Trends and Economic & Labour Market Review

data three months (T+3), six months (T+6), 12 months/one year (T+12), 24 months/two years (T+24), 36 months/three years (T+36), 48 months/four years (T+48) and 60 months/five years (T+60) later. This is a sample of the data held in the database, although any data maturity published since 1961 could have been presented.

Plotting a collection of different data maturities in the same chart gives a visual impression of the reliability of the successive maturity estimates. Ideally, each maturity would give the same estimate for a particular period, so they would all coalesce into the same line. At the other end of the spectrum, successive maturities wildly diverging would indicate poor reliability.

While the chart does not show estimates coalescing into a single line, the overwhelming impression is that the successive maturities have been closely concentrated for most quarters. Successive estimates of growth rates have not generally changed by large amounts sufficient to warrant substantially different interpretations of the economy's position or performance.

There are partial exceptions to this conclusion for a few quarters. In particular:

- In the second half of the 1980s, there was a period of consistent upward revisions, particularly in 1987 and 1988. Here the data was pointing to a slowdown in growth, and while this was eventually the case the actual slowdown, as described by the mature data, was far more gradual. The subsequent Pickford Review (1989) recommended a number of changes, the most significant of which was the publication of a single measure of GDP instead of separate output, income and expenditure measures as before.
- More recently, there was a period of significant upward revisions during 1998-99. Earlier estimates of GDP had pointed to a slowdown in growth, a view backed by business survey data such as the widely monitored Purchasing Managers Index (PMI). The Asian financial crisis of 1997-8 and the Russian crisis of 1998 which was then matched in Latin America, led to uncertainty and instability in the global economy at this time, but there was also an easing in UK monetary policy that supported domestic demand. This was picked up in later data maturities which showed the economy, especially aggregate demand, to have been more resilient in 1998 and stronger in 1999.

As a special case of Figure 1, **Figure 2** directly compares just the first data maturity with that published five years (60 months)

later. This is a harsh test since it includes revisions arising from methodological improvements as well as those from other sources. For the reasons given above, care is therefore needed in the interpretation. Nevertheless, these data suggest that, over a long period of time, first estimates have provided a good guide to the state of the economy – as described by estimates at maturities 5 years hence. So, although early estimates are likely to be revised, and this creates uncertainty for users, it seems rare that the data are changed to such an extent as to affect fundamentally the economic story they portray.

Metrics to help assess the quality of GDP

The quality of the National Accounts has a number of dimensions. For this reason, most National Statistics Institutions - including the ONS - refrain from trying to construct a single measure of the quality of GDP data. Instead, quality is expressed with respect to the standard European dimensions of quality - accuracy, timeliness, punctuality, accessibility, clarity, comparability and coherence. **Box 2** explains how ONS defines each of these in assessing the quality of GDP data.

For the preliminary estimates of GDP, the key quality issues would seem to be how early, and how accurately, its value can be assessed with some certainty. This relates to the *accuracy* benchmark, but also to *relevance* and *timeliness* in their availability and demand for use in policy-making. This approach to measuring quality puts information on revisions at the centre of the quality assessment.

Notwithstanding the caveats at the start of this section, appropriate metrics can be helpful in assessing the quality of GDP. Many different approaches can be used to summarise revisions, some of which are considered below.

Mean revisions

Mean (arithmetic) average revision between the estimate of GDP for time T at time T+*i* and time T+*j* is defined as:

$$MR_{i,j} = \frac{\sum_{t=1}^{N}\left(y_{t,i} - y_{t,j}\right)}{N}$$

Where N is the number of quarters in the span of estimates considered and $y_{n,T+i}$ is the i-th maturity of GDP data pertaining to the n-th quarter

Figure 3 presents the mean revisions between the first published estimate and those published 24 months later over four sub-samples from the long-run dataset. These are calculated as the quarter on quarter growth rate for GDP.

The key observations seem to be:

- mean revisions for all these sub-periods are all positive
- however, mean revisions have fluctuated considerably over time. In the most recent period (1995Q1 to 2004Q2), they were lower than in earlier periods, and, at only 0.05 per cent, insignificantly different from zero.

Although interesting as a broad summary description, mean revisions are of limited value for judging the size and significance of revisions. This is because average revisions can be relatively low simply because, in a given period, large downward revisions have been offset by large upward revisions. For this reason, mean squared revisions (MSR), or sometimes mean absolute revisions (MAR), are usually preferred.

Mean squared revisions (MSR) and Mean Absolute revisions (MAR)

The mean squared revision between the estimate of GDP for time T at time T+*i* and time T+*j* is defined as:.

$$MSR_{i,j} = \frac{\sum_{t=1}^{N}\left(y_{t,i} - y_{t,j}\right)^2}{N}$$

By squaring revisions, the estimate penalises large revisions at the expense of smaller ones.

In absolute terms, the mean absolute revision is defined as:

$$MAR_{i,j} = \frac{\sum_{t=1}^{N}\left|y_{t,i} - y_{t,j}\right|}{N}$$

In this case, large revisions would be treated as proportionately no more serious than smaller ones. But a downward revision would not offset an upward one for a different period – both being treated as representing a negative characteristic.

From a user perspective, a few large revisions to GDP are more likely to disrupt the reading of the economy than a preponderance of small ones, so producers of economic statistics are more sensitive to avoiding large revisions. For this reason, MSR is often preferred to the MAR, as a measure of the impact of revisions. Sometimes this is presented in its square root form, which essentially puts the metric onto the same scale as the revisions themselves.

Box 2

Dimensions for assessing the quality of GDP

The standard European dimensions of quality of statistical estimates are presented below.

Relevance

The degree to which statistical product meets user needs for both coverage and content

Accuracy

The closeness between an estimated result and its (unknown) true value.

Timeliness and punctuality

Timeliness refers to the lapse of time between publication and the period to which the data refer. Punctuality refers to the time lag between actual and planned dates of publication.

Accessibility and clarity

Accessibility is the ease to which users can access the data, also reflecting the formats in which the data is available and the availability of supporting information. Clarity refers to the quality and sufficiency of the metadata, illustrations and accompanying advice.

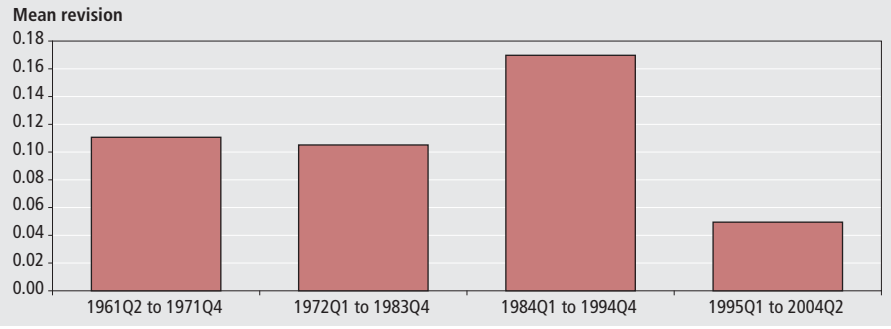
Comparability

This is the degree to which data can be compared over time and domain.

Coherence

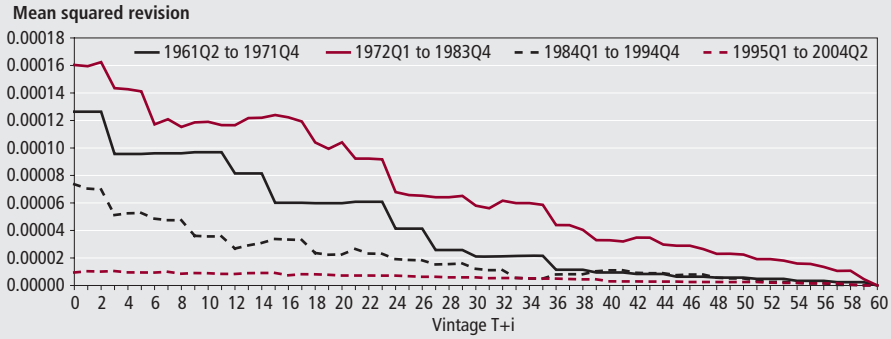
The degree to which data that are derived from different sources or methods, but which refer to the same phenomenon, are similar.

Figure 3
Mean revisions between T and T+24



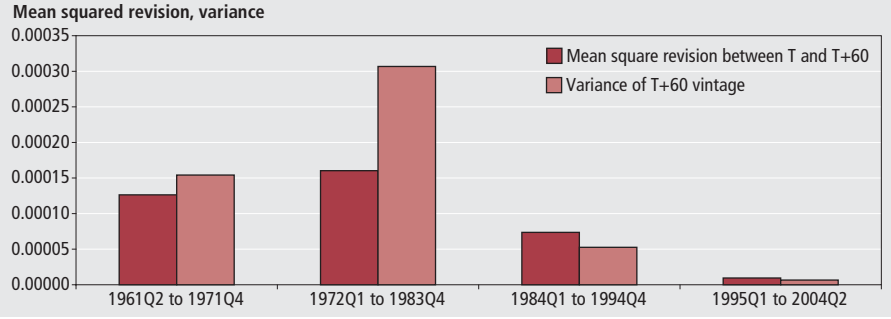
Source: Economic Trends and Economic & Labour Market Review

Figure 4
Mean squared revisions over different periods



Source: Economic Trends and Economic & Labour Market Review

Figure 5
Comparison of the T to T+60 MSR with the Variance of the T+60 Maturity



Source: Economic Trends and Economic & Labour Market Review

Using the same periods as in Figure 3, the mean squared revisions with respect to the T+60 maturity are shown in **Figure 4**.

While, for completeness, MSRs are shown up to maturities up to T+60, as noted earlier, this represents a harsh test since it includes in the measure effects of revisions due to methodological improvements. Nevertheless, the chart demonstrates a clear improvement in the quality of early GDP estimates in the most recent span compared to other periods. This reflects not just lower revisions between 1995Q1 and 2004Q2 (see Figure 3), but also a much smaller incidence of large revisions.

It should be borne in mind, however, that this improvement in quality may, at least in part, reflect the fact that the economy has been relatively stable over this last period. (Data relating to revisions stemming from the recession of recent quarters are obviously not yet available to include in the analysis.) Earlier estimates of GDP might be expected to be better relative to later maturities when the economy is growing smoothly than at times when there were sharper swings in the pace of economic growth. **Figure 5,** though not conclusive, gives some support to this hypothesis.

For the most recent period, 1995 to 2004, there has been a sharp decline in the mean squared revisions of the first published versus the T+60 published data, as compared with previous periods. However, the variance of the final data has also fallen considerably – as a result of the relative stability of the UK economy over this period. Simply put, it may be easier for earlier estimates accurately to predict later data maturities if the economy is less prone to significant fluctuations in activity or shocks.

Should early estimates of GDP be adjusted for bias?

Bias is defined as the mean revision (MR) over a given period of time. It is important to monitor carefully and continuously for its presence because, if persistent, it would indicate early estimates as being unnecessarily suboptimal. In particular, if it was the case that the direction and size of future revisions could be confidently predicted, as of now, then it would be possible to adjust for this bias straightaway. It would therefore be possible to arrive at the likely later maturity of estimate, deemed to be more reliable, at an earlier point.

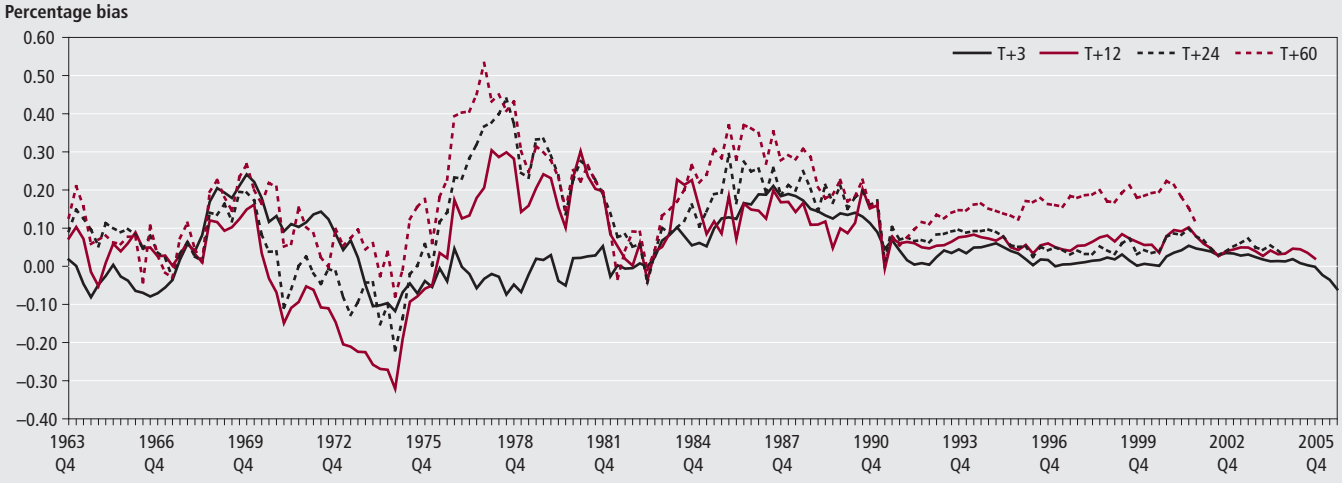
Bias adjustments, if available, might therefore be a tool that could be used to improve the early estimates. The Bank of England has undertaken considerable and impressive research into this (see Cunningham *et al* 2007). However, the feasibility of such adjustments depends upon the bias on which they are based being non-zero, and persistent and stable.

Some initial evidence as to whether these conditions hold is provided by F**igure 6.** This presents a five-year rolling average of revisions between the first published data maturities and a number of subsequent ones. The averages have been centred so that it is easier to monitor the timing of different bias.

The main observations are:

- in general, over the period 1963 to 2006 as a whole, bias has generally been positive implying that early data maturities are more likely to be revised upwards. However, there have been periods where the GDP data has been revised downwards
- over a long history of data, the size of bias in GDP is unstable. It looks as if it may also follow a pro-cyclical pattern, though the correlation is far from perfect
- since the early 1990s, the upward bias to GDP estimates has been small. The routine element of the bias (that is that

Figure 6
Rolling five year (centred) average of GDP revisions



Source: Economic Trends and Economic & Labour Market Review

Box 3
Case study in bias adjustment

Cunningham *et al* 2007 describe a state-space model to extract signal from noise in order to correct early ONS estimates for bias.

The paper aimed to produce a model to predict future movements in GDP estimates based on earlier ones and thus effectively reduce the future revision to these modelled estimates.

The Bank's paper and the wider issue of bias adjustment were discussed at the Government Statistical Service Methodology Advisory Committee in May 2008. Following this, ONS developed a research project, in conjunction with Professor Fred Smith of Southampton University, to look again at this issue.

The research analysed the mean revision between different maturities of estimates relating to the periods 1993Q1-2005Q2 (consistent with the Bank's dataset). These were tested to establish if the changes were significantly different from zero. A 'split sample' approach was also used (taking 1993Q1 – 1999Q1 and 1999Qq2-2005Q2) to test the stability of the results. Broadly, the results were:

- historically there is some evidence of bias in early estimates of GDP, certainly in the 1980s and early 1990s
- however, it is not clear that this has persisted into more recent periods. Testing revealed that revisions up to the time of the annual national accounts *Blue Book* produced two years after the relevant initial estimates were small and not significantly different from zero for recent data (1999Q2-2005Q2)

In general terms, the research concluded that revisions are not sufficiently large, regular or predictable to be able to support any process of bias adjustment.

which emerges from routine regular revisions, occurring up to T+24, as opposed to that which comes from unpredictable methodological changes) averages around only 0.05 percentage points.

These circumstances do not augur well for the success of incorporating bias adjustments into early estimates of GDP. **Box 3** summarises more formal analysis that has been undertaken. Its conclusions confirmed that incorporating bias adjustments intended to improve early GDP estimates was not currently viable. However, ONS will continue to monitor the evidence from revisions carefully, in respect of its implications for this conclusion. In addition, if causes of possible prospective bias should be identified - from the way data is collected, for example, or from methodologies that are used - ONS would expect to deal with those sources of bias as quickly as possible.

Conclusions

This article has examined the nature of the revisions process as it affects the estimates of GDP, and discussed ways to interpret the published information on revisions.

It has also presented some new analysis of revisions, based on a new long-run dataset for estimates of GDP, covering 1961Q2 to date.

Finally it has looked at the case for making an explicit adjustment to early estimates of GDP to factor in potential future revisions.

Broadly, the analysis in the article concludes:

- revisions are driven by two basically distinct processes: routine revisions arising from the addition of new information, and one-off revisions reflecting largely methodological improvements resulting in part from changes to international standards of measurement
- conflating these two sources of revision can lead to erroneous conclusions about both the quality of the early estimates of GDP and the extent and direction of potential future revisions
- comparison of the preliminary estimates with those published around two years later provides a reasonable basis for making like-for-like comparisons, and is helpful in understanding the underlying revisions process
- while, in an ideal world, it would be helpful to be able to predict in advance

the effects of future methodological improvements, in the real world, that is clearly not possible.

Using the new long run data base of revisions, which has now been made available, to analyse revisions to GDP over the last 50 years suggests that:

- revisions have more often than not been upward, but not always
- the pattern of revisions has changed over time. Broadly, there looks to be some correlation with the cycle but the relationship is far from exact
- since the mid-1990s, revisions have been smaller than in previous periods. Over maturities up to T+24, when most of the non-methodological changes will have been taken on board, the average revision is only +0.05 percentage points
- there is some suggestion that this better revisions performance may partly reflect that it is easier to measure the economy well, at an earlier time, when the economy is behaving relatively stably. The variance of GDP over this period was also lower than in previous times.

Although there is some evidence of historical upward bias in revisions, its extent and direction have not been stable or predictable. In addition, any such bias appears to have been smaller since the mid-1990s, and insignificantly different from zero. Overall, revisions are not sufficiently large, regular or predictable to be able to support any procedure of incorporating bias adjustments into early estimates. ONS will, however, continue to monitor revision patterns closely, to check whether any change to this conclusion might be warranted in future. Such information on revisions will be made public quickly, continuing the current practice.

CONTACT

elmr@ons.gov.uk

REFERENCES

Ashley J, Driver R, Hayes S and Jeffery C (2005) 'Dealing with data uncertainty', *Bank of England Quarterly Bulletin* Spring 2005

Bell M (2004) 'Monetary policy, data uncertainty and the supply-side: living with the statistical fog', speech to the Society of Business Economists, Wednesday 15 September 2004

Castle J and Ellis C (2002) 'Building a real-time database for GDP(E)', *Bank of England Quarterly Bulletin* Spring 2002

Cunningham A and Jeffery C (2007) 'Extracting a better signal from uncertain data', *Bank of England Quarterly Bulletin* Autumn 2007

Lomax R (2004) 'Stability and statistics', speech to the North Wales Business Club, Tuesday 23 November 2004

Mainwaring H and Skipper H (2007) 'GDP(O) revisions analysis system: overview and indicative results', *Economic & Labour Market Review* 1(10), pp 36–42 and at www.statistics.gov.uk/cci/article.asp?id=1879

Murphy J (2009) 'Revisions to quarterly GDP growth and its components', *Economic and Labour Market Review* April 2009

Youll (2008) Dealing with potential bias in early estimates of GDP, *Economic and Labour Market Review* July 2008

ARTICLE

John C Hughes, Gareth James, Andrew Evans and Debra Prestwood
Office for National Statistics

Implementation of Standard Industrial Classification 2007: December 2009 update

SUMMARY

ONS initially publicised its plans for the implementation of SIC 2007 in Hughes (2008), and this was followed up with an article covering a wider Government Statistical Service angle (Brook and Hughes 2009). This article describes the methodological aspects of the move to SIC 2007; lays out the implications for National Accounts; and gives an update on the timetable for implementation across the Labour Market Statistics outputs, some of the details of which have changed since the previous publication.

Introduction

Standard Industrial Classification (SIC) is a method of classifying businesses by their type of economic activity. The classification is used in the collection and presentation of data across the Government Statistical Service (GSS) and for administrative purposes, and by government and non-government bodies as a convenient way of classifying industrial activities into a uniform and common structure. The UK's SIC has been revised six times since its introduction in 1948, but SIC 2007 represents the first major revision since 1992 and follows a series of consultations in conjunction with a revision of the European Union's industrial classification system.

The implementation of SIC 2007 is reaching a key phase. During the next twelve months, most of the Labour Market Statistics will be published for the first time on a SIC 2007 basis, the short term business surveys will adopt the new classification from the start of 2010 and plans are being put in place for the National Accounts to move onto SIC 2007 in September 2011.

Methodological aspects of changing to SIC 2007

SIC codes form an integral part of the design of surveys. As such, the change in SIC has initiated a review of the processes involved in each survey – from data collection, through to dissemination of results. This section of the article provides some insights into the changes that are necessary to accommodate SIC 2007, and also describes some of the initiatives that are being introduced to coincide with the introduction of the new classification.

Business register

ONS maintains the Inter-departmental Business Register (IDBR), and uses it as the principal sampling frame for most business surveys. From the start of 2008, the IDBR has been dual-coded, meaning that each of the 2.1 million businesses listed is classified to both a SIC 2003 and a SIC 2007 industry code. The phased timetable for implementation of the new SIC means that some surveys will move to selection by the new SIC earlier than others. The first sample selections made using SIC 2007 as a stratifying variable were the Annual Business Inquiry and PRODCOM (Products of the European Community) in late 2008, and the last selections using SIC 2003 will be for the Stocks and Capital Expenditure surveys in late 2010 or early 2011.

The SIC 2003 codes will be retained on the IDBR until at least the end of 2011 by which time all surveys will be based on the new classification. After this a decision will be made regarding the ongoing maintenance of SIC 2003 on the register. This will be based on their usefulness given the inevitable deterioration in quality of the old codes over time, following adoption of SIC 2007 as the primary classification in early 2008.

Redesign of surveys - inputs

Most of ONS's business surveys are stratified by industry, as well as by size;

stratification gives greater control over coverage and makes more efficient use of the sample. As part of a rolling programme, each survey is being redesigned so that the survey's industrial strata, which have been formed as groups of SIC 2003 codes, will be replaced by groups of SIC 2007 codes. The new industrial strata have been chosen after consultation with users of the survey outputs. In addition, the boundaries used to form size bands are also under review, and all such changes necessitate a re-allocation of the sample. Together these initiatives should ensure most efficient use is made of the sample in meeting user requirements.

Some of the most visible changes in survey design will be seen by survey respondents, as a number changes relating to data collection are planned.

- Business survey sample selections operate on a rotational basis for smaller businesses; once selected initially for a survey, respondents remain in the sample for a number of periods before being rotated out. Changing the SIC will upset the regular patterns, and, around the time of the change, respondents may remain in the sample for a shorter or longer period than would usually be expected. ONS is trying to limit any additional burden on businesses as much as possible at this time.
- The dual SIC 2003 and SIC 2007 codes mean that some businesses will be classified to different sectors of the economy according to the different SICs. An example is the Publishing industry, which is part of Manufacturing under SIC 2003, and part of Services under SIC 2007. When the SIC 2007 redesigned surveys are implemented, respondents may find they start to receive an alternative questionnaire. The difference may just be in appearance, or it may contain different questions.
- Additional changes to the questionnaires used are also planned, and these will be implemented to coincide with the introduction of SIC 2007 to surveys. These include changes to the names of surveys (a number of current surveys will become part an integrated Monthly/Quarterly Business Survey from January/Q1 2010), and more extensive use is being made of Telephone Data Entry – an alternative to responding via paper questionnaires.

As noted elsewhere, SIC 2007 is being introduced to business surveys in a phased manner, and changes such as those listed have already occurred on a number of surveys, with the remainder being introduced in the near future.

Redesign of survey estimates – outputs

The presentation of estimates from business surveys with an industrial breakdown is currently based on SIC 2003. Along with the change in survey design, the reporting of outputs will also change to a SIC 2007 basis in the near future, and this will prompt a change to estimates in both first releases and historical back series.

ONS will make some outputs available on both SIC bases for a number of periods, but will be moving towards a SIC 2007 only approach in the future. The first outputs to appear on SIC 2007 are the Annual Business Inquiry and PRODCOM (for reference year 2008), and from the short-term surveys early in 2010. However, as agreed for all European countries the estimates for National Accounts series will continue on SIC 2003 until mid-2011, when the Blue Book will be published using SIC 2007, marking the end of the transition.

ONS will use a mix of two broad approaches in producing estimates on both SIC bases:

- The simplest approach, and one that will be adopted for historic periods, is use of conversion matrices. This method, a macro method, apportions industry estimates based on SIC 2003, and re-aggregates them to form SIC 2007 estimates; the proportions used for the distribution come from data on the IDBR. This method was used by ONS at the time of the last major change in SIC, and has been widely used by other National Statistics Institutes. It is the most practical method to use for historic periods, since dual-coded micro data are not available then.
- For more recent and current-period estimates, ONS will use a micro-method. In this, it is the individual survey responses that are re-weighted and re-aggregated to form the estimates for SIC 2007 based domains (domain estimation), as opposed to apportioning aggregate SIC 2003 estimates. The results using this method are of higher quality than those that would be obtained using conversion matrices, and the SIC 2007 domain estimates can be calibrated to appropriate population totals. ONS plans to use an analogous process to create SIC 2003 estimates for use in National Accounts from early 2010, when the surveys are redesigned, until mid-2011.

The impact of SIC 2007 on National Accounts

Timetable

The phased implementation of SIC 2007 across the ONS has, in the interim before publication of Blue Book in 2011, implications for the UK National Accounts. This is because many of the surveys that feed into the National Accounts will move from being collected on a SIC 2003 basis to being collected on a SIC 2007 basis before SIC 2007 is implemented into the National Accounts. To maintain consistency it will therefore be necessary for the survey outputs that feed into National Accounts to be converted back to a SIC 2003 basis.

The Annual Business Inquiry

The Annual Business Inquiry (ABI), which is one of the main surveys used in the annual balancing process to produce a consistent single measure of Gross Domestic Product (GDP) in current prices, is based on SIC 2007 from reference year 2008. Data from this survey for 2008 will be required for use in the annual Supply-Use balancing process for the National Accounts in 2010 - one year before the National Accounts are published on a SIC 2007 basis. To produce Blue Book 2010, the ABI data collected on a SIC 2007 basis for 2008 will be used and this will be converted back to a SIC 2003 basis using domain estimation (see the section on Redesign of survey estimates – outputs) for consistency until the full implementation of SIC 2007 in Blue Book 2011. Because of the time required to collect and process the ABI data, the annual balancing is done a year in arrears of the latest full year. Data for 2009 would not be used until 2011.

Quarterly National Accounts

Most ONS surveys that are used in the quarterly National Accounts will be collected from the first quarter of 2010 on a SIC 2007 basis. These data also will need to be converted back to a SIC 2003 basis until the National Accounts are published on a SIC 2007 basis in September 2011. There are several ways that this will be done within the ONS.

For certain surveys the conversion will be done at a very low level. Domain estimation will be applied to the source data, converting it back to a SIC 2003 basis. This treatment in particular will

be applied from January 2010 to the Monthly Business Survey, which is being introduced at the same time as the implementation of SIC 2007 and will replace the Monthly Production Inquiry (MPI) and the Monthly Inquiry into the Distributive and Services Sector (MIDSS). These surveys are used to produce the Index of Production (IoP) and the Index of Services (IoS) respectively. The IoP measures the volume of production of the manufacturing, mining and quarrying, and energy supply industries. The IoP is a short-term indicator in its own right and an important indicator of industrial activity. Further information can be found in Walton (2007). The IoS measures the monthly movements in gross valued added (GVA) for the service industries. Further information can be found in Morgan (2006). These are the primary indices used in the calculation for the output measure of GDP. GDP measures the sum of the value added created through the production of goods and services within the economy.

Non-ONS surveys

Government Statistical Service (GSS) staff in policy departments and the devolved administrations are responsible for the implementation of SIC 2007 for non-ONS surveys or administrative sources that are used in the National Accounts. This activity is being monitored through a GSS Steering Group responsible for co-ordinating the implementation of SIC 2007 across the Government.

With the exception of those for Northern Ireland, very few external sources impact on the National Accounts. The majority of the Northern Ireland sources are regular surveys which mirror key ONS surveys where coverage is limited to Great Britain (GB). GB and Northern Ireland outputs are combined by ONS to produce UK outputs. The Northern Ireland Administration has collaborated with ONS on an implementation timetable to ensure that UK estimates are preserved on a consistent basis for business and household surveys covering key economic outputs.

The other main external source of data that feeds into the National Accounts is from HM Revenue and Customs (HMRC). HMRC provide, on an annual basis, benchmark data that feed into the annual balancing process to determine the estimates of gross trading profits of private non-financial corporations and income data that is used for making estimates of wages and salaries.

Supply and Use Tables

Most National Accounts statistics are concerned with the composition and value of goods and services entering final demand (for example, purchase by consumers), with the outputs and incomes generated by the economic process. But they do not display the inter-industry transactions which link these activities. The Supply and Use Tables provide this linkage and give a firm basis for compiling a consistent single estimate of GDP at current prices by confronting various sources of data for production (output), expenditure and income in a Supply-and-Use framework. The single estimate of GDP at current prices for a reference year is important for the price adjusted volume estimates of GDP which are derived by applying expenditure deflators or direct volume measures to the reference year current price estimates.

It is important therefore that the levels of detail which are confronted in the Supply-and-Use framework are appropriate and that quality data exists to populate the framework. Currently the levels of detail used in the balancing process are 123 products by 108 industries and this will remain in place for Blue Book 2010. This is slightly smaller than the 123 product by 123 industries framework that had been used by ONS for many years up to Blue Book 2006.

The introduction of SIC 2007 and Classification of Product by Activity (CPA) 2008 with associated changes to their respective industry and product classification dictate that the current dimensions of the Supply and Use Tables will need to change for Blue Book 2011. CPA 2008 is an EU agreed statistical classification of products and services which all member states are legally obliged to use. Within Europe there was a shared view that the product classification should be based on economic origin and therefore replicate the framework of NACE[1] Revision 2 at a four digit level, which in turn reflects SIC 2007, the UK interpretation of NACE at a four digit level.

To establish what the new dimensions of the Supply and Use Tables should be ONS went through a process, initially identifying that the minimum requirement that Eurostat required was for data at a two digit level. Recognising that this would not necessarily satisfy users needs ONS then carried out an external consultation in the spring of 2009. Responses were received from more than thirty different organisations and individuals. These included major departments with policy interest, as well as regional interests and those of academics and 'lobby' groups. Most respondents recognised the practical limits on data quality, although many had clear policy needs which were not satisfied by the original proposal. Most made specific requests for additional detail.

All specific requests were evaluated against the following decision criteria:

- Is there a legal requirement? If so, then we should accomodate within the dimensions of the supply-and-use framework.
- Is there a clear user need? If so, does relevant data exist? If so, is the quality of data that exists suitable for producing robust estimates of GDP? If not, is there data available which provide a sound basis for pro-rating estimates down to the required level?

The last point ensured that any desired expansion of the matrix could be populated with actual data. Where these criteria were met, the dimensions of the matrix have been expanded to meet user needs. The main additions to the minimum two digit requirement were mainly related to expanding the transportation and food production categories to aid analysis of their environmental impact. On this basis the review of the consultation concluded that the matrix could be expanded to 114 products by 114 industries. This should result in minimal impact for users.

Modernisation of National Accounts

The modernisation of the National Accounts is being addressed under a new programme, ENABLE (Effective National Accounts and Blue Book to measure the Economy). As well as supporting the implementation of SIC 2007 and CPA 2008, the programme will facilitate production of better quality National Accounts, based on transparent procedures which are efficient, reduce the risk of error and free up resources to add value in the production of the accounts. The programme will produce a fully integrated system for the production of balanced estimates of GDP, the National Accounts and the Balance of Payments. The programme has specific focussed objectives which can be completed for use in Blue Book 2011.

For the annual balancing process for the National Accounts leading to the publication of Blue Book 2011 all relevant survey data used will be on a SIC 2007 basis, with back data converted from SIC 2003 to SIC 2007.

One of the main implications of implementing a significantly revised classification is the treatment of back data. The modernised systems that are being developed by the ENABLE project will have data back to 1997 on a consistent SIC 2007 basis. This will be achieved by converting data at an industry and product level from a SIC 2003 basis to a SIC 2007 basis. This should not result in any overall revisions to the whole economy level because it is just the reclassification of components. The treatment of data before 1997 is yet to be confirmed. ONS has established a project explicitly for the conversion of the long run time series published by National Accounts which go back to 1948. The project is responsible for the development of suitable methodology to link historic series. It is important to note that, for some very detailed series, it may not be viable to produce robust estimates. Additionally, some industries in the new SIC did simply not exist historically, notably in ICT and financial services.

Implementation of SIC 2007 across Labour Market Statistics outputs

Background

In autumn 2008 users were consulted on, and agreed to a plan which meant that most labour market statistics outputs would move to publication of industrial aggregates on the new SIC from June 2010. However, it has recently become clear that there are two necessary deviations from this plan:

Changes to the timetable

Vacancies Survey

This will now publish on SIC 2007 from February 2010. In line with other short term business surveys, the Vacancies Survey is due to start sample selection from the IDBR stratified by the new SIC from January 2010. The original plan was to continue converting industrial aggregates back to SIC 2003 until publication in June 2010. However given issues around resources to maintain both series and systems, also in the context of the resources required to support the fundamental redevelopment of the Workforce Jobs systems, this will no longer be possible. The Vacancies Survey industrial aggregates will therefore be published on a SIC 2007 basis once the survey switches to sample selection on the new SIC, that is the January 2010 estimates published in the February 2010 LMS Statistical Bulletin will be on a SIC 2007 basis.

Average Weekly Earnings (AWE)

The replacement for the Average Earnings Index (AEI) and its associated outputs will now publish on SIC 2007 from October 2010. The short term earnings estimates were also to be published on a SIC 2007 basis from June 2010. However the timing of the National Statistics accreditation of the AWE to replace the AEI, and the associated user demand from the Bank of England and Her Majesty's Treasury for a twelve month publication parallel run for AEI and AWE now mean that the original plan is not sustainable.

The parallel publication of the AEI and AWE began in October 2009 and will run until September 2010. It is not possible to sustain parallel running of both indicators on both the old and new classification bases, therefore the new SIC will not be implemented until the parallel run is complete. The AWE will therefore adopt SIC 2007 in the Labour Market Statistics Statistical Bulletin from October 2010. As it is being discontinued, the AEI will not be migrated to SIC 2007.

Labour Force Survey (LFS) aggregates

Users are reminded that, in terms of the switchover of LFS industrial aggregates to a SIC 2007 basis in the Labour Market Statistics Statistical Bulletin, only Table 24 (Redundancies by Industry) is affected. All other LFS tables with an industry breakdown are published in the Historical Quarterly Supplement and these will all convert to a SIC 2007 basis in August 2010, when the April - June 2010 results are published. Table 24 will be published on a SIC 1992 basis up to and including May 2010 (for the January - March 2010 dataset), and then first published on a SIC 2007 basis in June 2010. This will still be the January - March 2010 dataset as the redundancies estimates are currently only available on a calendar quarter basis rather than a rolling quarterly basis. More up to date estimates based on the April - June 2010 dataset will then be available on SIC 2007 in the August Statistical Bulletin, and so on. Plans are in place to move the redundancies estimates on to a rolling quarterly basis in line with most LFS based estimates in the Statistical Bulletin, and users will be consulted about this in due course. This will not be possible to implement until after the completion of the next re-weighting of historical micro data and so it is likely that Table 24 will continue to be available on a calendar basis only throughout 2010.

Summary of revised timings of SIC 2007 publication

Table 1 summarises the revised plans for release of industrial aggregates for Labour Market Statistics outputs. Revisions are shown in bold italics:

User analysis

Under the original plans for June 2010, there was an agreement in place between LFS users in government departments that they would continue to release LFS estimates aggregated by industry sections or divisions on a SIC 1992 basis until that date. This includes answers to Parliamentary Questions, except where it would be inappropriate or impossible to use SIC 1992, for example when detailed industry classes are requested. In these exceptions the use of SIC 2007 would be clearly signposted. This approach of waiting until June 2010 still stands.

Table 1
Summary of revised timings of SIC 2007 publication

Source	Planned first publication on SIC 2007
Labour Force Survey	June 2010 (for the Jan-Mar 10 dataset)[1]
Annual Population Survey	June 2010 (for the Jan-Dec 09 dataset)
Workforce Jobs	June 2010 (for Q1 2010 data)
Vacancies	***February 2010 (for January 2010 data)***
Labour Disputes annual article	June 2010 in ELMR
Productivity	September 2011 - in line with National Accounts
Public Sector Employment	June 2010 (for Q1 2010 data)
AWE (AEI replacement)	***October 2010 (for August 2010 data)***
Labour Cost Index	***October 2010 (for August 2010 data)***
Gross Wages and Salaries	***October 2010 (for August 2010 data)***
Annual Business Inquiry ABI/1	December 09 (for 2008 reference year)
Annual Survey of Hours and Earnings ASHE	November 09[2] (for 2009 reference year - 1st primary output on SIC 07).

Notes: *Source: Office for National Statistics*

1 See paragraph on LFS aggregates.
2 Both SIC 2003 and SIC 2007 published in Q1 2009 for 2008 ASHE.

Summary and next steps

As mentioned in the section on the redesign of survey estimates, ONS has been using conversion matrices to create historical time series on a SIC 2007 basis. Following the stabilisation of the IDBR on the new basis, ONS is now in a position to make some of these conversion matrices available for wider use. In this regard it is planned to publish three different correlations (based on turnover, employment and count of businesses) on the classification pages of the ONS website in early 2010. In addition, ONS can offer advice on the use of the correlation tables.

Data users will begin to see changes to short term survey outputs from the start of 2010. Monthly and quarterly data will be available on a SIC 2007 basis, starting with the release of the Retail Sales Inquiry (RSI) data on 19 February 2010. For most outputs, complete series on the basis of the new classification will be created using link factors to join sections of the series. However, revisions should be expected as part of later releases as it might take a couple of months for these link factors to settle. The length of back series and their availability will be determined mainly by legislation, but also by what is practical and useful. For example, a series measuring activity in the mobile phone industry prior to the 1980s might not be particularly illuminating. Back series requirements are likely to differ depending on the nature of the data, so ONS will endeavour to publicise its plans in this regard as they become available.

For structural business statistics, there will be no long run back series. ONS is producing ABI data on both classification bases for both reference years 2007 and 2008, initially for comparison purposes. ABI/1 data on both bases with respect to 2008 will be available through NOMIS[2] on 16 December 2009, whilst a decision on the availability of ABI/2 data will be made following further analysis.

ONS plans further ELMR articles throughout 2010, some of which will relate to specific data releases on the new basis. These will include details of the impact of the change in classification on the data, the availability of back series and resulting changes to revisions policy.

Notes

1. NACE is the European Union (EU) classification system for economic activities. The acronym NACE means 'Nomenclature générale des activitiés économiques dans le communautés européennes' although it is known in all member states simply as NACE.
2. NOMIS is a service provided by ONS giving free access to the most detailed and up to date UK labour market statistics from official sources (see www.nomiswebuk.co.uk).

CONTACT

elmr@ons.gov.uk

REFERENCES

Brook K and Hughes J (2009) 'Implementation of SIC 2007 across the Government Statistical Service', Economic & Labour Market Review, Vol 3 No 8. Available at www.statistics.gov.uk/cci/article.asp?id=2266

Hughes J (2008) 'SIC 2007: Implementation in ONS', Economic & Labour Market Review, Vol 2 No 8. Available at www.statistics.gov.uk/cci/article.asp?id=2034

Morgan D (2006) 'Summary quality report for Index of Services' Available at www.statistics.gov.uk/cci/article.asp?ID=1460

Walton A (2007) 'Summary quality report for Index of Production'. Available at www.statistics.gov.uk/CCI/article.asp?ID=1846

ARTICLE

Mark Chandler
Office for National Statistics

Labour Force Survey: Interim reweighting and annual review of seasonal adjustment, 2009

SUMMARY

On 11 November 2009 ONS published revised Labour Force Survey (LFS) aggregate estimates in the *Labour Market Statistical Bulletin* to take account of the latest available official population estimates and the results of the annual review of the seasonal adjustment of the LFS estimates. This article describes the new and revised LFS estimates and the time period affected. An outline of the reasons for making the revisions and of the basic methodology is also provided. This is supported by tables illustrating the total population estimates for the UK by age group and is then followed by a summary of how the revisions have impacted on the headline labour market indicators, that is the measures of UK employment, unemployment economic inactivity and average actual weekly hours as derived from the LFS. A summary of the revisions by Government Office Region (GOR) is also provided.

Key Points

- The LFS aggregate estimates in the *Labour Market Statistical Bulletin* have been kept consistent with the latest official population estimates and have been revised to reflect the changes to the seasonal adjustment for the period open to revision, that is June–August 2007 onwards.
- The resultant revisions to the headline labour market indicators do not significantly alter the overall picture portrayed over the last two years.

Introduction

On 11 November 2009 revised Labour Force Survey (LFS) estimates, that is, the aggregates in the *Labour Market Statistical Bulletin*, were published to take into account the latest population data and the results of the annual review of the seasonal adjustment of the estimates. The LFS data sets used for detailed analysis, known as LFS microdata, are not affected. They continue to be weighted to the population estimates published in the autumn of 2007, as described in the reweighting article published in May 2008[1]. See below for the definition of LFS aggregates and microdata.

On 27 August 2009 ONS published the 2008 mid-year population estimates for the UK. These were followed by the 2008-based National Population Projections for the UK on 21 October, which provided new estimates for mid-2009 onwards. These new and revised estimates have been incorporated into the calculation of the population figures that have been used to reweight the LFS aggregate estimates.

Defining the LFS aggregate estimates and microdata

The LFS "aggregate estimates" in the UK and regional *Labour Market Statistical Bulletins* are key labour market indicators, for example the levels and rates of employment, unemployment and economic inactivity. They are derived initially from the LFS 'microdata' and are calculated for any period of three consecutive months. These are referred to as three month rolling averages, that is averages for January to March, February to April etc. The aggregate estimates are seasonally adjusted.

LFS 'microdata' are quarterly data sets containing all survey questions. They are made publicly available as databases to enable external users to access and produce their own analyses. They enable more detailed analysis but are published for calendar quarters only (Quarter 1 refers to January to March, Q2 refers to April to June etc), and are not seasonally adjusted.

Background to the LFS

The LFS is a continuous UK household sample survey, which collects information from approximately 50,000 households each quarter (around 110,000 people of all ages). Since these responses reflect only a sample (approximately 1 in 500) of the total population, they are weighted on the basis of subnational population totals by

age and sex to give estimates for the entire UK household population.

In order to remain consistent with the LFS sample the population estimates as published are adjusted to exclude those outside the coverage of the LFS. Consequently people in communal establishments, apart from those living in National Health Service accommodation and students living in halls of residence who have a UK-resident parent, are excluded from the LFS household population estimates. A fuller description of the history of the LFS and its methodology can be found in the Labour Force Survey User Guide Volume One [2].

The LFS household population estimates are derived from the annual mid-year population estimates (MYEs) and latest projections based on those MYEs. These are updated annually and thus the LFS aggregate estimates can be revised on a similar basis - see interim reweighting below. Reweighting of the survey microdata to the revised population estimates is a resource-intensive exercise and, historically, has been carried out less frequently than annually. The last full reweighting exercise was carried out in 2007-08 and the results were published on 14 May 2008.

Interim reweighting

Since 2003 the LFS aggregate estimates have been 'interim reweighted' every year. Interim-reweighting applies adjustments to the aggregate results to reflect how the latest available LFS household population estimates compare with those used for weighting the microdata. This amounts to an approximation of the effect that a full reweighting of the microdata would have.

The interim reweighting ensures that the time series of the LFS aggregates is kept closely in line with the latest population estimates, thus reflecting a more accurate picture of the UK labour market.

A consequence of interim reweighting of the LFS aggregates every year is that they become inconsistent with the quarterly LFS microdata that are reweighted less often. Since the last interim reweighting in October 2008 this has applied to all quarterly microdata back to and including April-June 2006. The latest interim reweighting has added to this inconsistency for all quarterly datasets from July-September 2007.

LFS household population estimates

The official population estimates published in August and September 2009 indicate that the previously published population projection for mid-2008 was broadly in line with the 2008 MYE for people aged 16 and over, with a difference of 0.1 per cent. The variation is greater within some age groups than others: the number of people aged over state pension age had been underestimated by 0.3 per cent and the number of 18-24 year olds had been overstated by 0.4 per cent. The difference between the latest and previous projections for mid-2009 is negligible for the total population aged 16 and over, with some relatively larger revisions in the age groups affected by the 2008 MYE revision.

Table 1 compares the new LFS household population estimates by age group with those previously used.

The population estimates used for this latest interim reweighting have been derived from estimates produced at local authority level. Totals for the English GORs, Wales, Scotland and Northern Ireland are derived by aggregating the local authority estimates. Previous interim reweighting exercises have been based on estimates derived at the level of the GOR.

Using this new approach for interim reweighting, a more accurate estimate of the private household population is applied as changes to the age structures of local authorities over time are then reflected at national level. In addition the population estimates used for the interim reweighting are entirely consistent with those which will be used for the next full reweighting of the LFS microdata.

The largest revision introduced by this change is in Scotland for women aged 16 and over, for whom the population has been revised up by more than 1 per cent.

There were no revisions to the MYEs prior to 2008; therefore the LFS aggregates are open to revision for the period June-August 2007 onwards.

Revisions to LFS aggregates

The revisions due to interim reweighting of the seasonally adjusted aggregates include revisions arising purely from the updated seasonal adjustment. This is partly because previously published LFS aggregate estimates are not routinely revised, in accordance with the published revisions policy for Labour Market Statistics[3]. This means they each reflect the seasonal adjustment of the time series that existed at the time they were first published. The LFS aggregates are interim reweighted prior to being seasonally adjusted and then a fully revised time series is brought into the seasonal adjustment process. Consequently the seasonally adjusted estimates for all periods open to revision reflect the most up-to-date estimation of the seasonal factors, trends and irregular components as required.

As such, the implementation of the annual review of the seasonal adjustment of the LFS has coincided with the interim reweighting of the LFS aggregates. The remainder of this article will jointly examine the impact of the interim reweighting and the review of the seasonal adjustment on the headline aggregates by labour market status.

Generally, since the population revisions are included in both the numerator and denominator for the rate calculations, the revisions to the rates are very small, that is less than 0.1 of a percentage point and, in many cases, zero. Consequently the comparisons in this article focus on the levels rather than rates.

Table 2 compares the headline LFS aggregates before and after interim reweighting and the review and re-estimation of the seasonal adjustment.

Table 3 shows the revisions for the main LFS aggregates by age group. The relative sizes of the revisions tend to reflect the population revisions by age group as shown in Table 1.

Table 1
New and previous LFS household population estimates, by age band

United Kingdom — Thousands, except where indicated

	May–July 2008				May–July 2009			
Age band	New	Previous	Revision	% revision	New	Previous	Revision	% revision
16+	49,070	49,039	31	*0.1*	49,450	49,449	1	–
16–59/64	37,727	37,731	–4	–	37,916	37,935	–19	*–0.1*
16–17	1,589	1,591	–1	–	1,555	1,552	3	*0.2*
18–24	5,721	5,744	–23	*–0.4*	5,803	5,819	–15	*–0.3*
25–34	7,820	7,805	14	*0.2*	7,929	7,945	–16	*–0.2*
35–49	13,430	13,438	–8	*–0.1*	13,406	13,403	3	–
50–59/64	9,166	9,152	14	*0.2*	9,223	9,217	6	*0.1*
60/65+	11,343	11,308	35	*0.3*	11,534	11,514	20	*0.2*

Source: Office for National Statistics

Table 2
Revisions to headline LFS aggregates, May to July 2009

United Kingdom — Thousands, except where indicated

	New	Previous	Revision	Revision as a %
People aged 16+				
Economically active	31,344	31,361	–18	–0.1
In employment	28,874	28,891	–17	–0.1
Unemployed	2,470	2,470	–1	–
Economically inactive	18,106	18,088	18	0.1
Working age people[1]				
Economically active	29,926	29,950	–24	–0.1
In employment	27,489	27,513	–23	–0.1
Unemployed	2,436	2,437	–1	–
Economically inactive	7,991	7,986	5	0.1

Note: *Source: Office for National Statistics*

1 Men aged 16 to 64 and women aged 16 to 59.

Table 3
Revisions to main seasonally adjusted LFS aggregates by age group, May to July 2009

United Kingdom — Thousands

Age group	Economically active	In employment	Unemployed	Economically inactive
16–17	–1	0	–1	4
18–24	–15	–15	0	0
25–34	–11	–11	0	–5
35–49	3	2	1	0
50–59/64	0	0	–1	6
60/65+	7	6	0	13

Source: Office for National Statistics

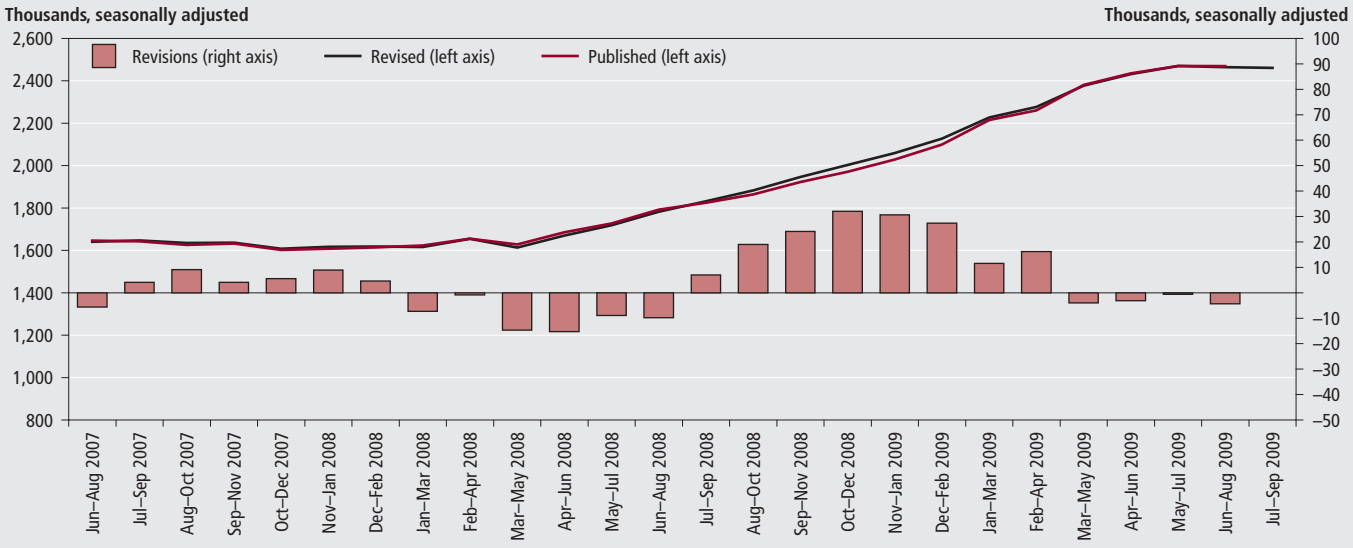
Unemployment estimates

The revisions to the unemployment series are primarily the result of the updated seasonal adjustment of the periods open to revision. This is a consequence of the revisions policy for the LFS estimates. After first publication of the estimates, the policy is to defer revisions for up to one year. As new data points improve the estimation of past seasonal adjustment factors, deferring revisions can have a cumulative effect. The recession has exacerbated this effect: as none of the new information has been used to update previously published seasonally adjusted estimates until now, the revisions are larger than normal. The cause of the revisions is best explained by the seasonal adjustment process itself, which is based on a simple three-stage process as follows:

1. estimate the trend
2. remove the trend
3. estimate the seasonal factor

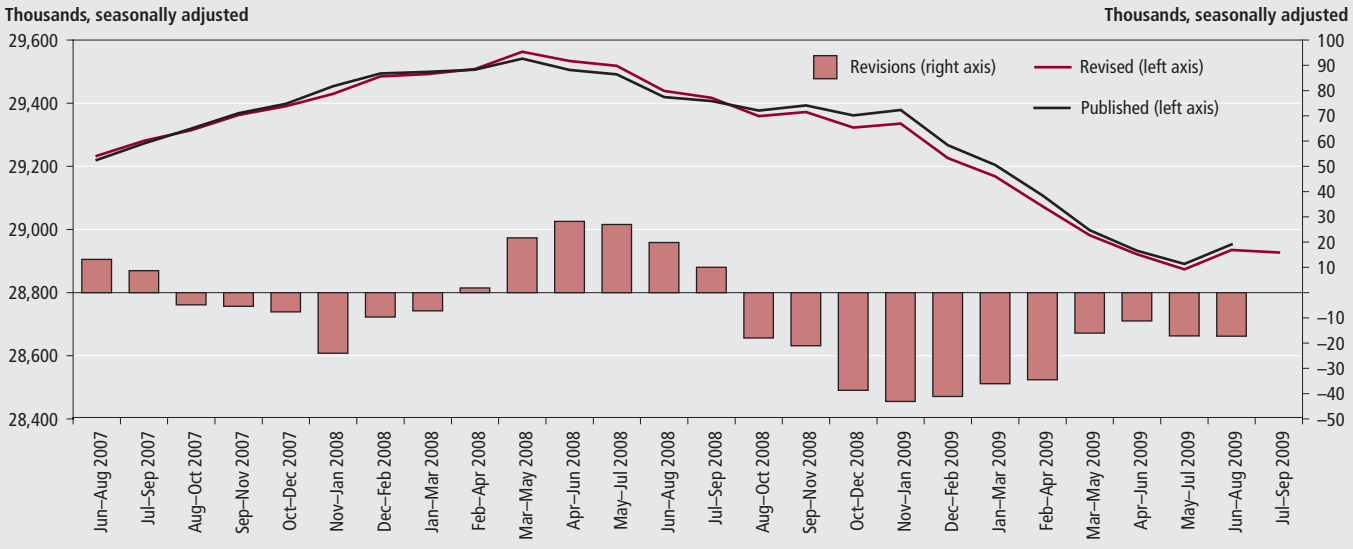
and is carried out using the X-12-ARIMA statistical tool. This tool uses moving averages to estimate the trend and the seasonal factors, and unless the series is artificially extended, these moving averages will be asymmetric at the start and end of the series. Research has shown that revisions are reduced by projecting and backcasting the series, using an ARIMA model, prior to stage 1 of the process. However, as the projections are based on the past, during the first part of the recession they consistently underestimated the sharp increase in unemployment. This in turn led to: an underestimate of the trend (stage 1); an overestimate of the detrended series (stage 2); and an overestimate of the seasonal factors (stage 3). As real data have replaced each ARIMA forecast: the trend has increased; so the detrended series has decreased; and the seasonal factors have decreased. As a decreased seasonal factor means an increased seasonally adjusted data point, this explains the positive revisions seen during the period July-September 2008 to February-April 2009, as shown in **Figure 1**.

Figure 1
Unemployment for people aged 16+, before and after interim reweighting



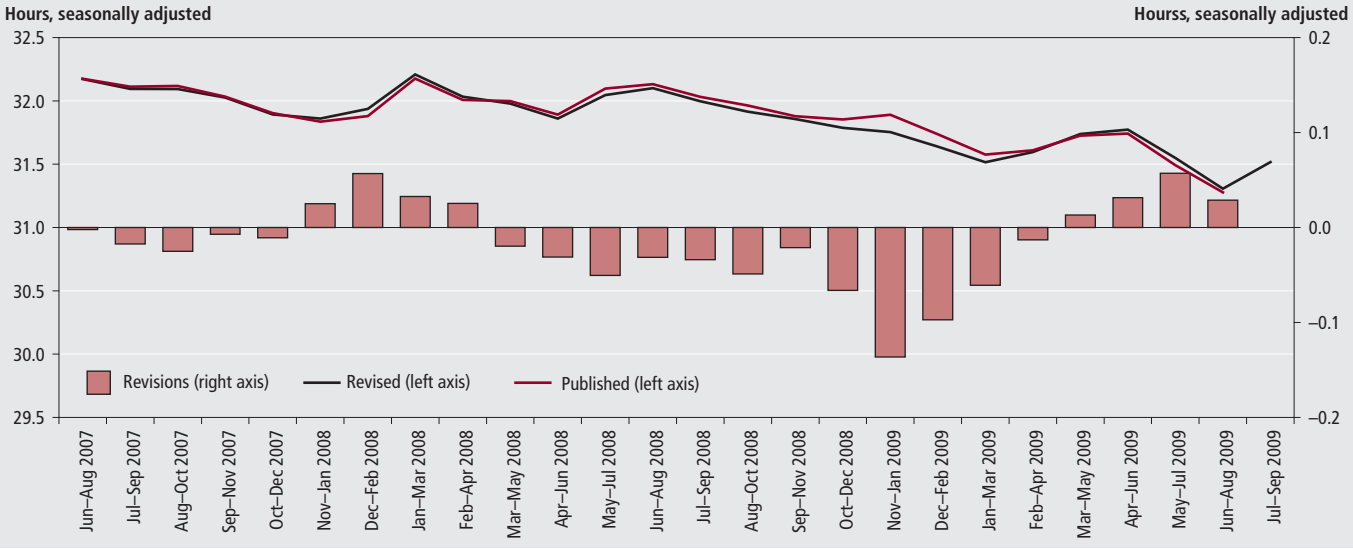
Source: Office for National Statistics

Figure 2
Employment for people aged 16+, before and after interim reweighting



Source: Office for National Statistics

Figure 3
Average hours worked, before and after interim reweighting



Source: Office for National Statistics

Employment estimates

Like the unemployment estimates, the estimates of the level of employment for people aged 16 and over also show the largest revisions during the period of most rapid change. The revisions to the employment estimates are the opposite of those seen for the unemployment estimates. For employment the seasonal factors have increased for the period August-October 2008 to February–April 2009 with the result that the seasonally adjusted estimates have been revised down, as shown in **Figure 2**.

Average hours worked

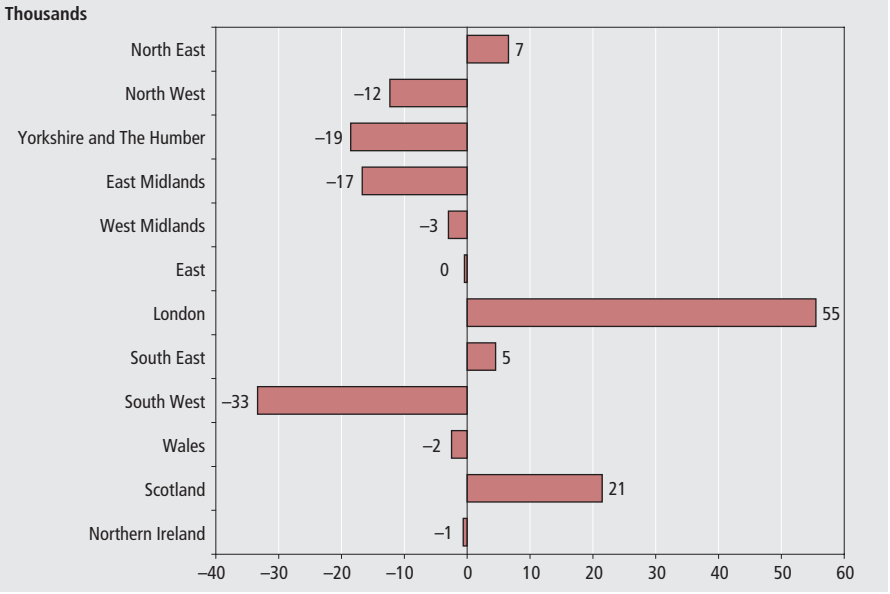
Some minor changes to the seasonal adjustment method have been implemented for the series in Table 7 of the *Labour Market Statistical Bulletin*, that is, the average actual weekly hours of work. These statistics measure the number of hours actually worked by respondents during the week surveyed. They are affected directly by changes in the number of hours individuals work, in particular those caused by time off due to holidays. A number of 'calendar effects' related to holiday periods can cause distortions to the seasonal adjustment of the actual hours worked series, these are:

1. **Late May bank holiday** - which falls in either the May or June survey period.
2. **August bank holiday** - which falls in either the August or September survey period.
3. **Easter** - which usually falls in either March or April, and sometimes affects the May survey period.
4. **Christmas** - which falls in either the December or January survey period, or sometimes straddles both.

LFS historical data are used to model the impact of the calendar effects. Adjustments are then derived from that analysis and are used to remove the calendar effects during the seasonal adjustment process. Following the 2009 seasonal adjustment review these adjustments have been updated.

Another calendar effect can result from the shifting of the survey reference

Figure 4
Revisions to LFS household population aged 16+, by Government Office Region, May to July 2009



Source: Office for National Statistics

Table 4
Revisions to main seasonally adjusted LFS aggregates by GOR, May to July 2009[1]

United Kingdom Thousands

GOR	Economically active 16+	In employment 16+	Unemployed 16+	Economically inactive (16–59/64)
North East	5	3	2	2
North West	–9	–8	–1	–4
Yorkshire and The Humber	–14	–12	–2	–1
East Midlands	–11	–11	–1	–4
West Midlands	3	3	0	–1
East	2	5	–3	0
London	34	30	5	10
South East	–7	–6	0	7
South West	–31	–29	–2	–3
Wales	–3	–3	0	–2
Scotland	12	10	2	2
Northern Ireland	2	1	1	–1

Note: *Source: Office for National Statistics*

1 The economic activity catergories correspond with the headline aggregates as published in Table 18 of the Labour Market Statistical Bulletin.

periods by one or two days each year, called the 'phase shift' effect. For example, the survey period for January to March 2008 covered the period 24 December to 23 March, whereas that for the previous year covered 25 December to 24 March. This is because questions in the LFS refer to respondents' situation in the previous week, covering the period Monday to Sunday inclusive. Every six years or so, a one-week survey break is needed to bring the survey calendar back into line with the real calendar; this last occurred in October 2008.

Since spring 2008 the 'phase shift' effect has been applicable for two of the actual hours worked series contained in Table 7, that is women working part-time and all people working part-time. The latest review has concluded that the phase shift effect is also applicable to the women's series for all workers and an appropriate adjustment has therefore been made.

The impact of the revised seasonal adjustment settings and of the updated seasonal adjustment factors for the average actual weekly hours for all workers is illustrated in **Figure 3**. As can be seen most of the revisions to the previously published statistics are very small and are no bigger then 0.1 hours and are similar to the pattern of the revisions to the employment series. The revised average hours estimates have had an effect on the estimates of total weekly hours worked, also shown in Table 7 of the *Statistical Bulletin*. The revisions to the series follow those of the average weekly hours and the employment series.

Redundancy estimates

As part of the seasonal adjustment review all series are assessed for seasonality, in essence, whether they demonstrate effects associated with the time of year. In the past, estimates of the redundancy level for men were regarded as seasonal, whereas those for women were regarded as non-seasonal. Consequently the series for men has been seasonally adjusted in the standard manner whilst that for women has not. Total redundancies are derived from the sum of these series and so were regarded as seasonally adjusted.

The latest review has concluded that the redundancies series for men no longer displays any statistically significant seasonality and so should not be seasonally adjusted. Consequently the redundancies total is no longer a seasonally adjusted total either. The impact of these changes is not significant since, in the past, seasonally adjusted estimates were usually very similar to the non-seasonally adjusted estimates.

The redundancy rates included in Table 23 are the ratio of the redundancy level to the seasonally adjusted number of employees in the previous quarter. The rates continue to be regarded as seasonally adjusted.

Revisions by Government Office Region (GOR)

Figure 4 shows the revisions to the May-July 2009 LFS household population estimates for people aged 16 and over, broken down by Government Office Region.

The largest revision was an upward revision of 55,000 for London. The largest downward revision was for the South West at -33,000. In percentage terms the revisions to the LFS household population for people aged 16 and over for all regions were less than 1 per cent.

Table 4 shows the revisions for the main LFS aggregates by region, as found in Table 18 of the *Labour Market Statistical Bulletin*. As for the age group breakdown, the revisions to the results generally reflect quite closely the revisions to the estimates of the LFS household population.

Conclusion

The LFS aggregate estimates for key labour market indicators have been interim

reweighted to bring them into line with the latest official population estimates. There are no significant changes to the statistical story.

The full set of interim-reweighted aggregates is included in the *Labour Market Statistical Bulletin* and supplementary tables, as published on 11 November 2009.

ONS aims to ensure that the LFS estimates continue to be kept in line with the latest population estimates. In the shorter term, the current plan is that fully reweighted LFS microdata will be released early in 2010, either with the publication of quarter 4 2009 results in February 2010 or with the quarter 1 2010 results in May 2010. The precise timing is dependent on the progress made with the development of a new set of system tools for carrying out the reweighting process. The LFS aggregates in the *Labour Market Statistical Bulletin* will then be brought exactly into line with the LFS microdata. The revisions to the aggregates at that point are expected to be negligible. In the longer term, it is envisaged that the full reweighting of the LFS microdata will be carried out every year, thus avoiding the need for any interim-reweighting of the aggregate estimates. Details of these longer term plans will be announced in due course.

Notes

1. www.statistics.gov.uk/cci/article.asp?id=2011
2. www.statistics.gov.uk/downloads/theme_labour/Vol1-Final-2009.pdf
3. www.statistics.gov.uk/about/Methodology_by_theme/downloads/LM_revisionspolicy.pdf

CONTACT

elmr@ons.gsi.gov.uk

ARTICLE

Patterns of non-employment, and of disadvantage, in a recession

Richard Berthoud
Institute for Social and Economic Research, University of Essex

SUMMARY

There has been much commentary on the likely consequences of the current recession for the living standards of British households. This article aims to contribute to the live debate about the current recession in the UK by analysing the impact of the recessions of the early 1980s and 1990s on non-employment patterns among people in the main range of working ages – and the possible consequences if the effects observed in earlier business cycles were to be repeated now. The article uses a series of General Household Surveys over a 32 year period to show, first, the impact of cyclical factors on overall patterns of non-employment (including mothers and disabled people, as well as the unemployed), and second, which social groups are most affected. A key question is whether types of people who are already disadvantaged are especially sensitive to a downturn.

Key findings

- There has been much commentary on the likely consequences of the current recession for the living standards of British households. Between February to April 2008 and May to July 2009 the unemployment rate increased from 5.3 per cent to 7.9 per cent, and between March 2008 and June 2009 the claimant count doubled from 2.4 per cent to 4.8 per cent
- This short article aims to contribute to the live debate about the current recession in the UK by analysing the impact of the recessions of the early 1980s and 1990s on non-employment patterns among people in the main range of working ages. Two complete business cycles are observed, while long-term trends in patterns of non-employment are also taken into account
- People are defined as 'non-employed' if they worked less than 16 hours per week, and were not studying at the time they were surveyed. Note that dividing the labour market in this way departs from ILO and ONS Labour Market Statistics, which separate the economically active and inactive
- The analysis is based on the General Household Surveys undertaken almost every year between 1974 and 2005, with a total sample of 360,672 adults. Their risks of non-employment can be related both to the year in which they were interviewed and to other characteristics such as family structure, age, qualifications and so on. Complex interactions between characteristics and annual measures of the health of the labour market can be used to estimate what the position in 2005 (the end of the GHS sequence) would be, first if there was no recession and second if there was a hypothetical recession where the unemployment rate doubled
- Most narratives concentrate on the rate of unemployment as the key indicator – counting only those who are actively seeking work. But the analysis suggests that non-employment rates among other groups (such as mothers or disabled people) are also influenced by cyclical effects. For every 100,000 increase in the number of unemployed people, the analysis suggests a further increase of 27,000 in the number of people reporting that they do not have a job, for other reasons
- It has been suggested that those already facing labour market disadvantage would be most likely to face additional problems if jobs are scarce. That is not the consistent conclusion of the analysis
  - The findings for education and ethnic group tend to support the vicious-circle-of-disadvantage hypothesis: people with poor educational qualifications, and members of minority ethnic groups, are both exceptionally sensitive to a recession
  - The findings for gender, age and disability tend to the opposite, implying that existing disadvantage is stable across business cycles.

Women, older people and disabled people have poor underlying job prospects, but are not much affected by a temporary downturn
– There is no consistent pattern suggesting that people living in already disadvantaged regions are either more or less sensitive to cyclical factors than more prosperous regions

Introduction and background

The economic downturn following the crisis in the financial services industry has stimulated a spate of commentary on the possible consequences for households and families. Obvious potential economic impacts on unemployment (Stafford and Duffy 2009), poverty (Muriel and Sibieta 2009) and mortgage repossessions (Daily Telegraph 2009) may lead to less obvious adverse personal outcomes, including rises in burglaries (Guardian 2009), divorce (Blekesaune 2008), mental illness (Time 2009) and child abuse (Independent 2008).

This article focuses on the labour market. The US National Bureau of Economic Research (NBER) defines a recession as:

> 'a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real gross domestic product (GDP), real income, employment, industrial production and wholesale-retail sales' (NBER 2009).

This broad definition is often operationalised statistically to identify a recession as a period of two consecutive quarters of negative economic growth measured by GDP. But the NBER definition stresses a range of potential indicators, and some economists argue for an increase in the rate of unemployment – by more than (say) one-and-a-half or two percentage points in 12 months – as the best single indicator (Eslake 2008). Unemployment statistics are both understood by, and potentially threatening to, the general public, and therefore play an important political role. Looking at the three-month periods February to April 2008 and May to July 2009 the UK unemployment rate rose by 2.6 percentage points from 5.3 per cent to 7.9 per cent. Between March 2008 and July 2009, the claimant count rate doubled, rising by 2.4 percentage points from 2.4 per cent to 4.8 per cent. Unemployment peaked at above 10 per cent in both the two previous recessions.

What types of people are likely to find themselves out of work in consequence? Does the lack of demand in the labour market primarily affect people who were disadvantaged already? Or is it 'ordinary people' with average characteristics who find themselves at heightened risk of unemployment? Or does a recession tend to eat away at the privilege of those who had previously been almost certain of carrying on in work?

The existing literature on the relationship between unemployment trends and social disadvantage has been usefully reviewed by Stafford and Duffy (2009). The evidence base is patchy. Much of it looks at trends over a single recession, often analysing data about the downturn before information about the upturn is available. It focuses mainly on unemployment itself (that is, people actively looking for a job) as the undesirable outcome, without much attention being paid to the impact of recessions on the number of people out of work for other (reported) reasons. Many studies have focused on one particular disadvantaged group (lone parents, disabled people, ethnic minorities and so on) without direct comparisons between groups, or allowing for the interactions between characteristics.

This short article aims to contribute to the live debate about the current recession in the UK by analysing the impact of the recessions of the early 1980s and 1990s on non-employment patterns among people in the main range of working ages (20–59).

People are defined as 'non-employed' or 'not in work' if they did not have a job and were not studying at the time they were surveyed. The definition is as close as possible to a NEET (not in employment, education or training) as the data will allow, but differs from official/conventional definitions of 'in work' and 'not in work'. In particular, those in full time education are assumed to be making a long-term investment so are classified as being 'in work'; and those working less than 16 hours per week are counted as 'not in work' on the grounds that the short hours cannot be considered as a primary activity.

Two complete business cycles are observed, while long-term trends in patterns of non-employment are also taken into account. Although unemployment rates are used as the measure of the level of demand in the labour market (a predictor variable), overall non-employment probabilities are used as the outcome measure (the dependent variable), including a cyclical rise in the number of people not even looking for work as part of the potential problem. The analysis systematically compares the experiences of different social groups, defined by gender and family structure, age, education, health, ethnicity and region, allowing for and investigating the effects of combinations of these characteristics.

The next section describes the data source – an almost annual sequence of General Household Surveys over three decades. The following section describes the analytical approach, followed by aggregate findings about the overall effect of a recession on the number of adults not in work. The penultimate section shows how much more or less sensitive to cyclical variations the non-employment rates of particular groups are. And the final section discusses the findings, looking for a link between long-term disadvantage and short-term problems.

Data: the General Household Survey

The main aim of this article is to distinguish between long-term and cyclical trends in the non-employment rates of different social groups. It is based almost entirely on a long-running population survey, rather than on published statistics on unemployment and other benefit claims.

The General Household Survey (GHS) is a continuous multipurpose survey of large random samples of households across Great Britain. The survey has been conducted, using a new sample each time, every year since 1973, with the exception of 1997 and 1999. The latest evidence in the dataset analysed here relates to 2005.[1] In practice, the 1973 survey did not have full data on economic activities, and the 1977 and 1978 surveys did not carry the standard question on limiting long-standing illness. These three annual surveys were therefore dropped from the analysis. The database therefore provides 28 annual observations, over a 32 year period.[2]

Structure of the sample being analysed

The analysis in this article is based on adults aged 20 to 59. Young adults, aged 16 to 19, have not been included because such a high proportion of them are still in full-time education. Men aged 60 to 64 have been omitted because, although still below pensionable age, a high proportion of them have in fact retired – and in this age group, 'early retirement' is sometimes a marker of privilege and sometimes a marker of disadvantage. Where an adult within the age range has a partner under 20 or over 59, the former is included and the latter

excluded – but we know whether the excluded partner had a job.

Each of the 28 annual GHSs included in the analysis covers between 10,000 and 16,000 men and women within this age range, with an overall total of 360,672 respondents. Weighting factors have been applied so that each annual survey represents the composition of the relevant year's population by age and sex. These weights are calculated as the ratio of population size to sample size, so that they can be used as grossing up factors to estimate the number of people in the population who have been affected.

All the annual surveys asked questions about respondents' economic activity, and about the set of personal characteristics that are known to be associated with people's job prospects. Some of these questions (notably age and sex) were asked and coded identically in every survey, and could easily be compared across the sequence. Others, notably educational qualifications and ethnic group, were asked and/or coded in different ways across the sequence, and an important preparatory task was to ensure that these data were recoded to be as comparable as possible from year to year.

As with all research of this kind, the findings should be treated just as 'estimates', with a margin of error either way associated with sampling considerations, measurement uncertainties and analytical simplifications. It is the broad differences and trends that matter. The **Appendix** provides details of sampling errors in the main analytical model.

Definitions of non-employment and of unemployment

In this analysis people have been defined as 'not in work' if they did not have a job, and were not studying at the time they took part in the survey. The definition is as close as the survey data can get to 'NEET' – not in employment, education or training, A job of less than 16 hours per week was counted as 'not in work', on the grounds that very short hours cannot be considered either a primary activity or a means of earning a living. The 16 hour cut-off is enshrined in current social security and tax-credit legislation, although the formal boundary was at 30 hours at the beginning of the period under review.

Full-time education has been classified as 'in work', because it is long-term economic investment, strongly supported by government policy. The proportion of those defined as 'in work' who were students rose from 1.1 per cent in 1974 to 3.6 per cent in 2003. They were concentrated among those in their 20s. It is possible that scarcity of jobs is one of the factors that encourages young people to stay on in the education system, and the opportunity cost of education is lowered in a recession, but these issues are not addressed in this analysis.

All references in this article to 'non-employment ' and synonyms such as 'out of work' refer to this NEET-based definition, which slightly differs from the NEET definition used by ONS (see Barham et al 2009). In 2005 (the most recent GHS year in the dataset), the non-employment rate ('out of work' as a proportion of all adults in the age range) was 25 per cent, the converse of an overall employment rate of 75 per cent.

But the words '*un*employed' and '*un*employment' refer more narrowly to people seeking work. In between the unemployed and people in work is a group of those who have no job, but are not looking for one, known as 'economically inactive'. The unemployment rate reported by the GHS in 2005 (based on the International Labour Organization (ILO) definition) was 3.3 per cent.

Figure 1 plots changes over the period in measures of unemployment and the claimant count:

- The figure based on the Labour Force Surveys (LFS), using the ILO definition for those of working age in Great Britain – this is the source used for official headline estimates of unemployment[3]
- The GHS based figure, again using the ILO definition, confined to 20–59 year olds in Great Britain
- The claimant count figure, for those of working age across the UK. This is based on a count of the number of people claiming the relevant benefits, mainly the Jobseeker's Allowance and its predecessors Unemployment Benefit and Income Support

The ebbs and flows that are crucial to the analysis in this article are clearly visible, and the three rather different measures of unemployment are highly correlated. The main differences are:

- The GHS indicated a peak in unemployment in 1983, and the LFS in 1984, while the claimant count reported a continuing increase through to 1986
- The LFS figures have been rather higher than the other two, especially in the early 1980s and over the most recent period

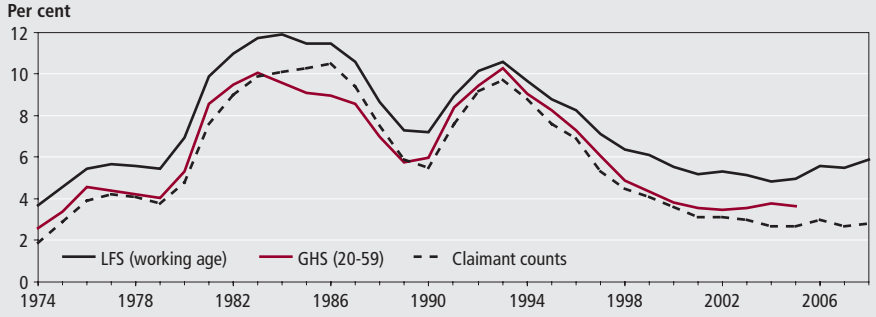
The analysis in this article is based on the GHS measure.

Analytical approach

The article uses logistic regression techniques to estimate the probability that any member of the GHS sample was not in work in any year. That probability will be influenced both by the supply side (the individual's preference for work and the set of skills s/he has to offer), and by the demand side (employers' need for workers). The question to be addressed is how sensitive individuals' non-employment probabilities are to variations in aggregate demand, holding supply-side characteristics constant.

1. The analysis focuses mainly on whether an individual is not in work, rather whether s/he is unemployed. Clearly the unemployed (looking for a job) are the group of primary concern, given that their current situation is one that they are positively trying to escape. It is often assumed that economically

Figure 1
Annual unemployment rates, 1974–2008, measured by the Labour Force Survey, by the General Household Survey and by official clamant counts



Source: GHS and ONS Labour Market Statistics

inactive people have chosen not to work and are not of concern. The extent to which these choices are freely made in the long term is open for discussion (Berthoud and Blekesaune 2007). But the important point in the current context is that any *increase* in the non-employment rates of (for example) mothers or disabled people *directly attributable to a cyclical scarcity of jobs* is unlikely to have been the outcome of autonomous changes in their preferences, and so should be considered one of the outcomes of a recession.

2. It is important to take account of *all* the influences on people's job prospects before reaching conclusions about the importance of any *one* of them. A multivariate analysis is used here, in which gender and family structure, age, education, health, ethnicity and region are all considered as potentially independent predictors of non-employment probabilities. Rather than simply report how many (for example) disabled people do not have a job, the approach offers the opportunity to estimate how much higher the non-employment rate of disabled people is than that of non-disabled people with otherwise similar characteristics. This net difference – a 'disability employment penalty' (Berthoud 2008) – can be compared with similarly-calculated penalties for mothers, ethnic minority groups and so on (Berthoud and Blekesaune 2007).
3. The analysis compares year-by-year changes in the labour market advantages or disadvantages experienced by different social groups, with year-by-year changes in the unemployment rate, used as an indicator of ups and downs in the business cycle. If the non-employment rate of any group remained constant, regardless of booms and busts, then it could be concluded that the group was unaffected by recessions. If their non-employment rate fluctuated widely in a pattern closely synchronised with the national indicator of labour demand, then it could be concluded that the group was highly sensitive to market conditions – and the analysis provides an estimate of the numbers affected. This approach uses the conclusions about the early 1980s and 1990s to suggest what might happen if there were a hypothetical recession and a doubling of unemployment at the end of the sample in 2005.
4. A constant non-employment rate is not necessarily the appropriate counterfactual baseline against which to compare the outcome of a recession. While the overall proportion of GHS sample members in and out of work remained fairly steady over the long term (once cyclical effects have been ironed out), some of the social groups of interest (such as mothers) have seen a fairly steady improvement in their job expectations, while others (such as disabled people) have seen a fairly steady deterioration (Berthoud 2007). For these groups, what matters is the extent to which their non-employment rate departed from their underlying trend during a recession and recovery. **Figure 2** plots year-by-year changes for one example group whose non-employment rate fell over the period and another whose rate rose. The analytical challenge is to identify the M shaped pattern of response to cyclical variations (see Figure 1) superimposed on a steady trend. If the underlying trend was not taken into account, the cyclical effect would be substantially underestimated when the trend is upwards, and overestimated when the trend is downwards.
5. The fifth point is obvious, but needs to be made explicit. The past is the only, but not an ideal, guide to understanding current events. Analysis of the impact of the recessions in the early 1980s and 1990s is intended to highlight the possible consequences of the recession now in progress. There are all sorts of differences between the three events – in the starting situation, in the causes of the crisis and in the policy responses – which mean that study of the first two cannot be used to predict the pattern of the third with any precision. The analysis should nevertheless offer a guide to the likely impact of the current downturn on the welfare of individuals.

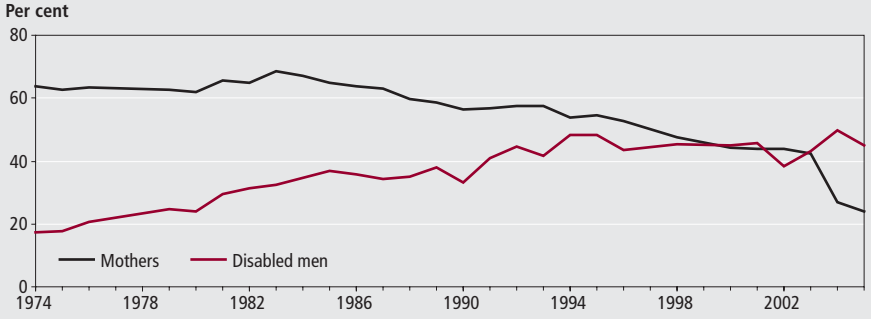
Overall trends in non-employment probabilities

A first step is to establish that cyclical variations in the proportion of potential workers who report that they are unemployed are associated with parallel trends in the proportion of adults who are not in work for other stated reasons. **Table 1** does this using a multinomial regression equation, in which each of the alternatives to being in work (16 hours plus) is analysed distinctly. The equation controls for underlying trends by including the sequence of years as a predictor (1974–2005, numbered 0 through 31), and also the square of the numerical sequence. This incorporates an assumption that any long-term rises or falls were continuous, but not necessarily linear.

Since the annual unemployment rate is calculated from the number of people reporting that they were unemployed, it is hardly surprising that the one strongly predicts the other. The important point of the analysis in Table 1 is that all the other alternative outcomes also tended to rise during periods of rising unemployment, and fall during periods of falling unemployment (with the exception of the unimportant 'other/not known' category).

The temptation is to use this multinomial approach to predict how sensitive disabled people, older workers and women are to changing market conditions, using the categories 'incapable of work', 'retired' and 'home or family' as indicators of the three groups' experiences. The difficulty with such a solution is that the choice of label is often subjective, depending partly on what the individual was doing before, and partly on current

Figure 2
Illustration of rising and falling trends in annual non-employment rates among specific groups



Source: GHS

Table 1
Multinomial regression equation using annual unemployment rate and annual trend to estimate specific labour market activities

		Multinomial coefficients		
	Proportion of all, 2005 (per cent)	Annual unemployment rate	Trend (year)	Trend (year2)
a) In work, 16 hours or more	*73*	Reference category	Reference category	Reference category
b) Work, less than 16 hours	*5*	**0.021**	**0.022**	**–0.001**
c) Student	*2*	0.018	**0.049**	0.000
d) Unemployed	*3*	**0.152**	**0.032**	**–0.001**
e) Incapable of work	*5*	0.011	**0.096**	**–0.001**
f) Retired	*2*	0.024	**0.166**	**–0.003**
g) Home or family	*8*	**0.038**	**–0.043**	**0.000**
h) Other/not known	*2*	–0.023	–0.001	**0.001**

Note: *Source: GHS 1974–2005, adults aged 20–59*

1 Coefficients in bold are significant (p<0.05)

Table 2
Three ways of explaining the relationship between annual unemployment rates and annual non-work rates

		Analysis of individual probabilities (logistic regression)	
	Analysis of yearly averages (OLS)	Without controls	With controls
Annual unemployment rate	**0.011**	**0.051**	**0.066**
Trend (per year)	**–0.003**	**–0.009**	0.006
(year squared)	**0.000**	0.000	0.000
(Pseudo) R^2, per cent	*97*	*0.4*	*25.5*
N of observations	28	360,672 individuals in 28 clusters	360,672 individuals in 28 clusters
Percentage effect of increasing unemployment by 3.3%	*3.49*	*3.59*	*3.25*

Notes: *Source: GHS and author's estimates*

1 See the Appendix for full details of the logistic regression equation with controls.
2 Coefficients in bold type are significant at the 95 per cent confidence level.

normative considerations about appropriate social and economic roles. These norms have changed over time, leading to trends in the number of people explaining their non-work in different ways, which do not necessarily match rises or falls in their non-employment probabilities.

Instead, the analysis later in this article shows how many members of each specific group did not have a job (as defined). Not having a job seems a more objective fact and, ultimately, more important than the reason given. Moreover, the chosen approach allows finer-grain analysis, controlling for more factors than the categorisation used in Table 1.

Note that the definition of non-work used in the analysis is based on categories b, d, e, f, g and h as labelled in Table 1, so the overall non-work rate was 25 per cent in 2005. (5+3+5+2+8+2). The ILO definition of unemployment rates expresses category d as a percentage of a+b+d. This gives a figure of 3.3 per cent in 2005. Because the bases for the percentages are not the same, a percentage point change in non-employment would refer to more actual people than a percentage point change in unemployment. This will become clear as examples are given in the following paragraphs.

A first step is to analyse annual non-work rates using the annual characteristics – current unemployment rate and trend – as the predictor variables. There are three ways of doing this.

- The first column of **Table 2** shows the results of an ordinary least squares (OLS) regression in which each year in the sequence is treated as an observation, using the annual unemployment rate and the year-on-year trend as the predictors. It shows that for every rise or fall of 1 percentage point in the unemployment rate, the non-work rate rose or fell by 1.1 percentage point. This means that if unemployment in 2005 had doubled, from 3.3 per cent to 6.6 per cent, the non-work rate would have increased by 3.5 percentage points
- The second column of Table 2 shows the results of a logistic regression equation. It estimates the probability of non-employment of each individual in the sample, once again using the annual unemployment rate and the year-on-year trend as the sole predictors.[4] The logistic regression coefficient of 0.051 is not easy to interpret, but it can be calculated that doubling the 2005 unemployment rate from 3.3 per cent to 6.6 per cent would lead to an increase in the non-work rate of 3.6 percentage points
- The last column of the table shows the results of a similar logistic regression equation that also controls for the effects of a wide range of other personal characteristics on non-work probabilities. These other effects are recorded in the Appendix and may be interesting in their own right; but the important point for the current objective is that controlling for these characteristics suggests a slightly weaker underlying relationship between unemployment and non-work than appeared in the logistic specification without controls – a doubling (3.3 percentage point rise) in the 2005 unemployment rate would lead to a rise of just under 3.3 percentage points in the overall non-employment rate[5]

The estimate of the effect of doubling the 2005 unemployment rate will be used again and again in the following pages to illustrate the estimated effects of the recession on particular groups of people. It is calculated by:

- using the logistic regression equation to estimate the non-employment probability of each 2005 sample member under 2005 conditions, and
- adding 3.3 x the relevant coefficient to the prediction formula,[6] and re-estimating the non-employment probabilities in 2005 under the hypothetically revised conditions

The approach is similar in concept to the calculation of marginal effects, except that the estimate refers to a plausible change in actual conditions rather than to an infinitesimal change. 2005 is used because it is the most recent year available in the dataset. Doubling the unemployment rate is assumed because that is what happened to the claimant count rate over the 15-month period to June 2009.

So the best estimate is that a rise of 3.3 percentage points in the unemployment rate is matched by a rise of 3.25 percentage points in the overall percentage non-work rate. Applying these figures to 2005 conditions implies that:

- Doubling the unemployment rate represents an increase of 812,000 in the number of unemployed people aged 20–59 (defined as looking for work)
- An increase of 3.25 percentage points in the proportion of all adults (in that age range) not working represents a total rise of joblessness attributable to weakened demand of 1,034,000
- It can be concluded that the number of jobs directly affected by cyclical factors is about 127 for every 100 individuals recorded as unemployed

Based on this analysis, the rise in unemployment therefore undercounts the total number of people whose jobs are affected by a recession. The difference between the two counts is not massive, and it can be concluded that the number of people not working on grounds of disability, early retirement and motherhood is somewhat, but not exceptionally, sensitive to fluctuations in the number of jobs available.

Effects on social groups

The overall effect of fluctuations in labour demand on the number of people out of work is not difficult to estimate and the fact that some 'unemployment' is hidden among people who report other reasons for not having a job is not a new idea (Beatty and Fothergill 2005). But the detailed year-by-year data provided by the GHS offers an opportunity to analyse the rises and falls in joblessness among different social groups to show, for example, whether it is men or women, or well-qualified or poorly qualified, whose prospects are most sensitive to market conditions. Do disabled people, or members of minority ethnic groups, face additional disadvantage during downturns in the economy, or is their position already so weak that macro-economic changes make no difference?

The main logistic regression equation covering all groups and the whole period is set out in the Appendix. Including (say) education and the annual unemployment rate in the same model tells us that people with no qualifications are generally less likely to have a job than graduates in all years, and that the overall non-employment rate fluctuates with the business cycle for people of all educational backgrounds. But this does not differentiate between the effects of the business cycle on those with low and high qualifications. The analysis needs to estimate the pattern of changes over time for each social group.

This has been done by adding a set of interaction terms to the equation that provide estimates of the effects of both underlying trends and cyclical variations in demand on each of the original predictor variables. The detailed results are in the Appendix. The model takes account of the direct effects on non-work probabilities of 30 characteristics, and also allows for 30 distinct trends, and 30 distinct cyclical patterns.

Models with large numbers of interaction terms are too complex to be interpreted directly. The trick is to repeat the approach already used to summarise the overall cyclical effect.

- The current non-work probability of each member of the 2005 sample is predicted taking account of all characteristics and their interactions
- A hypothetical non-employment probability is then calculated for each 2005 sample member assuming a 3.3 percentage point increase in the unemployment rate, and applying that to all the interactions between characteristics and unemployment rates
- This provides an estimate of the increased risk of non-employment for every sample member. Variations in this increased risk can be analysed across the key characteristics of interest
- Reported effects are averaged across adults in the 2005 sample

This is done in the following paragraphs for the following characteristics in order: gender/family structure, age, disability, educational qualifications, ethnic group and region.

Gender and family structure

Preliminary analysis suggested that the most efficient way of describing variations in non-employment patterns was to compare all men (excluding the small number of lone fathers), women without dependent children living with them, and mothers (plus lone fathers). This three way distinction provides the basis for **Table 3**, illustrated by **Figure 3**.

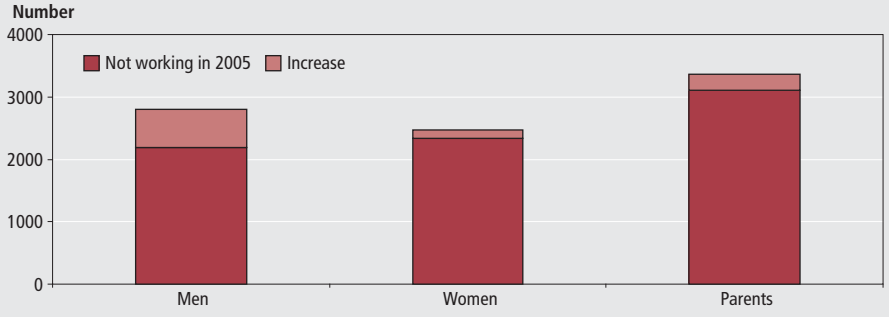
By 2005, the estimated non-employment rate among men (as defined) had risen to nearly 15 per cent as the result of long-term trends. Among parents (mostly mothers, as defined), it had fallen to about 38 per cent, while childless women were in between at 27 per cent. But a rise of 3.3 percentage points in the unemployment rate is expected to have substantially more impact

Table 3
Logistic regression estimations of the relationship between annual unemployment rates and overall non-work probabilities, by gender and family structure

	Men (except lone fathers)	Women (except mothers)	Parents (mothers + lone fathers)
Per cent estimated not to be working in 2005	*14.7*	*27.0*	*37.8*
Per cent estimated if unemployment doubled	*18.7*	*28.6*	*41.0*
Estimated increase, percentage points	*4.0*	*1.6*	*3.1*
Number not working in 2005 (thousands)	2,196	2,335	3,111
Estimated increase (thousands)	603	135	258
Proportionate increase, per cent	*27*	*6*	*8*

Source: GHS and author's estimates

Figure 3
Predicted changes in number of non-employed people in 2005 conditions, by gender and family structure[1]



Note:
1 See main text for definitions of the categories.

Source: GHS and author's estimates

Table 4
Logistic regression estimates of the relationship between annual unemployment rates and non-work probabilities, by other social characteristics

	Per cent estimated not to be working in 2005	Estimated increase		
		Percentage points	Thousands	Proportionate, per cent
Age				
20–24	*22.4*	*5.7*	215	*26*
25–29	*22.9*	*4.8*	189	*21*
30–34	*24.2*	*4.1*	167	*17*
35–39	*23.1*	*3.3*	140	*14*
40–44	*19.4*	*2.6*	113	*13*
45–49	*19.9*	*2.1*	81	*10*
50–54	*26.5*	*1.7*	62	*7*
55–59	*36.3*	*1.3*	53	*4*
Disability				
Not disabled	*19.2*	*3.3*	890	*17*
Limiting long-standing illness	*53.5*	*2.1*	99	*4*
Education				
No qualifications	*46.1*	*4.0*	176	*9*
Lower	*30.8*	*4.6*	137	*15*
O level/GCSE	*25.7*	*2.7*	198	*11*
A level	*18.7*	*2.2*	106	*12*
Higher/degree	*16.5*	*2.5*	243	*15*
Ethnic group				
White	*23.2*	*2.9*	815	*12*
Caribbean	*27.7*	*5.2*	24	*19*
Indian	*28.3*	*4.2*	36	*15*
Pakistani Bangladeshi	*47.0*	*6.9*	44	*15*
Other	*35.0*	*5.2*	70	*15*
Region				
Scotland	*22.2*	*2.0*	55	*9*
North East	*27.0*	*1.5*	20	*6*
North West	*24.5*	*3.4*	101	*14*
Yorks and Humber	*25.5*	*3.0*	109	*12*
East Midlands	*24.7*	*3.8*	96	*15*
West Midlands	*25.8*	*5.1*	144	*20*
Wales	*26.1*	*2.3*	36	*9*
Eastern	*22.3*	*3.2*	102	*14*
London	*26.8*	*3.8*	144	*14*
South East	*23.2*	*2.7*	122	*12*
South West	*21.9*	*2.1*	58	*10*

Source: GHS and author's estimates

on men (4.0 percentage points) than on parents (3.1 percentage points), with childless women least affected (1.6 percentage points).

The second half of Table 3 presents the percentages in terms of the number of people affected. Two million 'men' would have been out of work for one reason or another in 2005 anyway. They would be joined by more than a further half million if unemployment had doubled. Larger numbers of 'women' and 'parents' who would not have been working in any case, are relatively unaffected by a potential recession. The number of men out of work would increase by more than a quarter; the number of childless women by little more than 1 in 20.

Age

Table 4 reports estimates for a series of other population groups calculated in the same way as the results by gender and family structure in Table 3, though presented in less detail. Analysis by age shows that the overall proportion not working in baseline 2005 conditions tended to be higher for people aged in their 50s, and especially their late 50s, compared with younger age groups. But it is clearly people at the beginning of the age-sequence analysed who are most susceptible to the potential impact of a recession. The non-employment rate among 20 to 24-year-olds would increase by a quarter, while the rate for 55 to 59-year-olds would rise by only 1 in 25.

Disability

There has been much discussion of the possibility that the rapid rise in the number of disabled people claiming out-of-work benefits over the 1980s and early 1990s was caused by the industrial restructuring and fiscal retrenchment during the 1980s (Beatty and Fothergill 2005). A more detailed analysis of trends in the non-employment rates of disabled people (using the same GHS dataset) is in progress – preliminary findings suggest that disabled people are highly sensitive to *geographical* variations in the health of the labour market, but not very sensitive to variations *over time*.

The General Household Survey does not carry detailed questions on the nature and severity of people's impairments, such as would be required to define 'disability' with any precision. Instead, it identifies sample members who report a limiting long-standing illness – a question that has been shown to exaggerate estimates of the number of disabled people in the working-age population, and underestimate the extent of their labour market disadvantage (Berthoud 2007).

If disabled people (those reporting a limiting long-standing illness) followed a similar trajectory in the current downturn as they did in the 1983 and 1993 recessions, they would experience a 2.1 percentage point rise in their non-employment rate – rather lower than that faced by non-disabled people. The rise would be only a small proportionate increase compared with the very high rate of non-employment already faced by disabled people.

Education

Educational qualifications have a strong influence of people's chances of having a job, as well as on the type of work and level of earnings they can expect. Nearly half of the shrinking group of people with no qualifications are estimated to have been out of work in 2005 conditions, even before the hypothesised recession. But only a sixth of the growing group of graduates and others with higher educational qualifications would have been out of work in baseline 2005 conditions.

The third panel of Table 4 shows that under-qualified potential workers have been exceptionally sensitive to previous recessions, and are predicted to suffer a substantial increase in non-employment during the current period; while well-qualified individuals are much better protected against the vagaries of the labour market.

Unlike the analyses by gender/family, age and disability, the analysis by education suggests that those already disadvantaged will be most at risk of further disadvantage. One consequence is that the proportionate increase, recorded in the final column of the

Figure 4
Variations in raw unemployment rates across the business cycle, in regions of low, middle and high underlying unemployment[1]

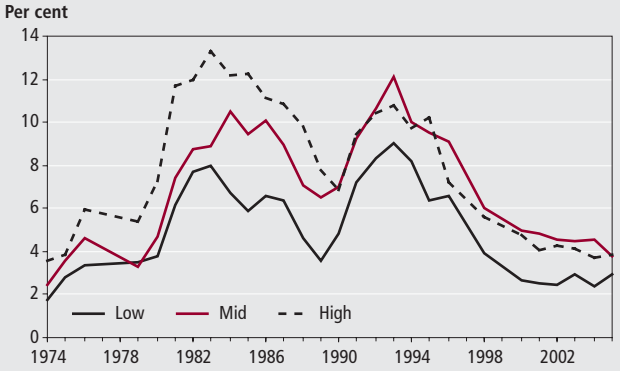
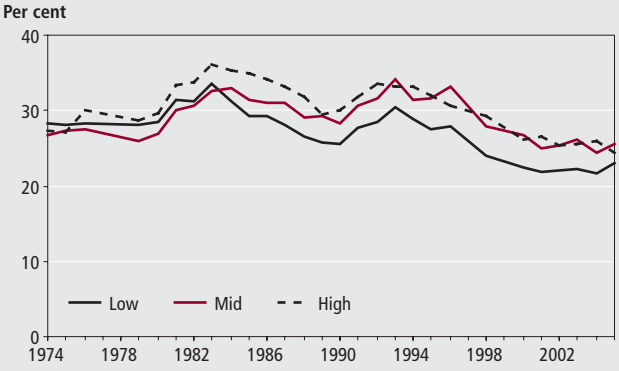


Figure 5
Variations in overall non-employment rates across the business cycle, in regions of low, middle and high underlying unemployment[1]



Note:

Source: GHS and author's estimates

1 Underlying unemployment is calculated as the mean unemployment rate in each region, over the whole 32 year period. Low rates are in Eastern, South East, South West and East Midlands (< 6 per cent); mid rates are in London, Wales and North West (6–6.9 per cent); high rates in West Midlands, Yorkshire/ Humberside, Scotland and North East (>=7 per cent).

table, is fairly constant across qualification categories.

Ethnic group

It has long been observed that the unemployment rates of ethnic minorities are 'hypercyclical' (Smith 1977, Jones 1993), rising faster than white unemployment rates during recessions, but falling faster during periods of economic growth. This means that an assessment of minority non-employment rates is sensitive to the period in the cycle that is under consideration.

The current analysis estimates overall non-employment rates (not just unemployment), and differentiates between the main minority groups. A complication is that the composition of the minority population has changed over the decades being analysed, following migration, so the projection of 1980s and 1990s experience to the 2000s is less reliable.

Nevertheless, the conclusions are largely consistent with previous studies. Pakistani and Bangladeshi groups, already among the most disadvantaged in the country, are also shown to be highly sensitive to a potential recession, with an estimated increase in non-employment of nearly 7 percentage points. All the minorities, though less disadvantaged in normal times, also exhibit the hypercyclical pattern.

Region

The non-employment rate in the base conditions of 2005 ranged between just under 22 per cent in the South West, and 27 per cent in the North East. It is well known that unemployment rates vary between regions, but **Figure 4** and **Figure 5** show that long-term prosperous and disadvantaged regions have fluctuated over the business cycle in parallel with each other. Table 4 shows that doubling the 2005 unemployment rate is estimated to increase the proportion of people out of work by between 1.5 percentage points in the North East, and just over 5 percentage points in the West Midlands

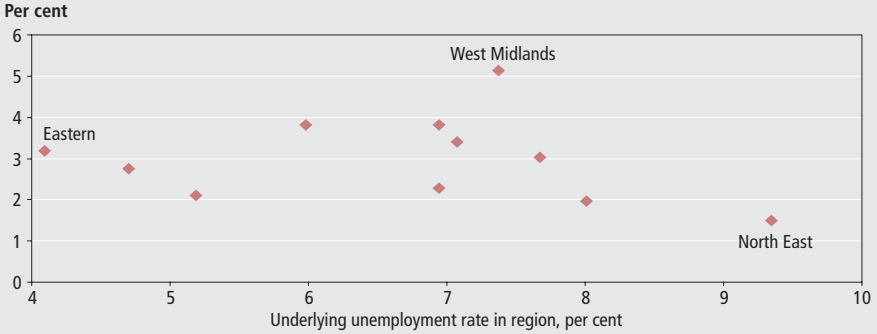
Table 4 listed the regions in an order roughly from north to south. There is no obvious north/south divide in the sensitivity of labour markets to cyclical effects. An alternative perspective is offered in **Figure 6**, which plots the estimated increase in non-employment in each region against the region's underlying unemployment rate (calculated as its mean unemployment rate across the 32-year period). Again, there is no obvious relationship between the underlying health of a regional economy and its response to a downturn.

Conclusions

Rises and falls in job opportunities are so directly linked to cyclical patterns of growth and decline in national output that some experts propose trends in unemployment statistics as the key measure of the health of a national economy.

This article uses survey data covering a 30-year period, analysing the experience of the past two recessions to predict the probable impact of the current downturn on individuals. Of course, no two circuits of the economic cycle are identical, but the past is the only, if imperfect, guide to what is happening now. The analysis is designed to show, first, whether the reduction in the number of people in work is confined to, or larger than, the number reporting themselves to be unemployed (available for and actively looking for work); and, second, what kinds of people (men or women, young or old, and so on) are likely to be affected. The analysis is based on a multivariate logistic regression equation which takes account both of changes in the characteristics of the population, and (crucially) of longer-term trends in the

Figure 6
Estimated increase in non-employment associated with a recession: regions plotted against their underlying unemployment rate



Source: GHS and author's estimates

Figure 7
Relationships between baseline non-employment probabilities and the increased risk associated with a recession[1]

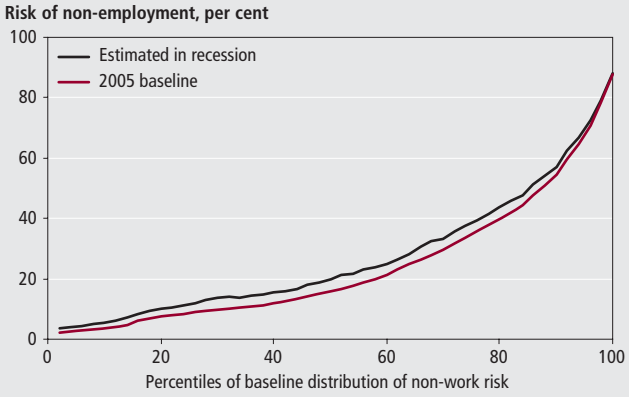
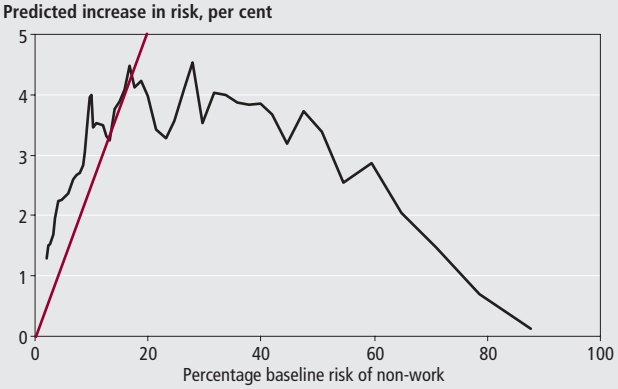


Figure 8
Relationships between baseline non-employment probabilities and the increased risk associated with a recession[1]



Note: *Source: GHS and author's estimates*

1 Both graphs are based on dividing the distribution of baseline risks into 50 equal groups, each covering 2 per cent of the total. The left-hand graph plots these according to their number in the sequence; the right-hand graph plots them at their mean baseline risk.

non-employment risks of particular groups. An analysis of the whole 32-year period covered by the GHS is used to 'estimate' the outcome of a hypothetical recession occurring in 2005 (the latest year in the data sequence) in order to provide an insight into what is happening now, in 2009. The hypothesised macro-economic event is a doubling of the national unemployment rate, from 3.3 per cent to 6.6 per cent. A larger change in unemployment (as happened in previous recessions) would lead to different outcomes – but the pattern of variations should be similar.

At an aggregate level, the analysis confirmed that the reduction of the number of people in work would be larger than the increase in the number of unemployed. Bear in mind that macro-economic trends impact on a continuous process by which men and women leave work and find new jobs. An increase of 100,000 in the unemployment count does not mean that exactly that number of people were made redundant. It is the net outcome of a rise in the rate at which people leave work, and/or a fall in the rate at which they start new jobs. Other non-workers, besides the unemployed, participate in these outflows and inflows, so that scarcity of jobs might (for example) encourage a disabled person to give up work a little earlier than s/he might otherwise have done, or discourage a mother from finding a job until a little later than she might otherwise have done. The scale of this rise in the number of 'discouraged workers' during a recession is not as great as might perhaps have been feared – an increase of 127,000 in the total number of people not in employment, for every 100,000 who say they are unemployed.

The General Household Survey data provide a unique opportunity to identify the social characteristics of those most and least affected by a recession. For adults aged 20–59 taken as a whole, the increase in the non-employment rate, estimated if the strictly measured unemployment rate doubled, was 3.25 percentage points. For the sub-groups identified in Tables 3 and 4, this effect fell as low as 1.3 percentage points (55–59 year olds) and as high as 6.9 percentage points (Pakistani and Bangladeshi groups). The groups most affected are men, younger adults, not disabled, with poor educational records, members of ethnic minorities, and those living in the West Midlands. Those least affected, conversely, are women without children, older age groups, disabled, with good qualifications, white, and living in the North East of England.

It is far from easy to generalise from these observed patterns. It has been suggested that those already facing labour market disadvantage would be most likely to face additional problems if jobs are scarce. That is not the consistent conclusion of the analysis.

- The findings for education and ethnic group tend to support the vicious-circle-of-disadvantage hypothesis.
- The findings for gender, age and disability tend to the opposite, implying that existing disadvantage is stable across business cycles. This is particularly surprising for disabled people, whose deteriorating job prospects over the decades have often been blamed on the experience of earlier recessions
- There is no consistent pattern suggesting that already disadvantaged regions are either more or less sensitive to cyclical factors than more prosperous regions

The output from the logistic regression equations can be used to address the relationship between baseline prospects and cyclical sensitivity more directly. The analysis estimates the non-employment probability of every member of the (2005) GHS sample, based on his or her characteristics; and the change in that predicted probability associated with a hypothesised recession. Those with low baseline probabilities of being out of work (positioned on the left in **Figure 7** and **Figure 8**) tend to be men, young, not disabled, with degrees, white, and living in the South West. Those with poor prospects, a high baseline probability of non-employment, are depicted on the right of the graphs – they tend to be mothers, older, disabled, with no qualifications, members of minority groups, and living in the North East. The graph in Figure 7 illustrates the baseline distribution of non-work probabilities, and also the predicted outcome of a recession. It can be seen that the increase in non-work risk is broadly spread across the distribution of initial probabilities, rather than bunched mainly at one end or the other.

Figure 8 re-presents the data from Figure 7, this time plotting the average increase in non-work probabilities directly against the baseline probability. The pattern can be summarised in three stages:

- Among adults with a fairly low risk of being out of work – up to about 20 per cent – a recession can be expected to increase that (low) risk by about a fifth. That is 1 percentage point for people with a 5 per cent starting risk, rising to 4 percentage points for those with a starting risk of 20 per cent. (The pattern is illustrated by the sloping straight line.) About 6 out of 10 adults are in this range with a steady *proportionate* increase in their risk
- Across the middle of the range of initial disadvantage, between about 20 per cent and 50 per cent, the further increase in risk is steady at about 4 percentage points. About 3 out of 10 adults are in this already-disadvantaged range, facing a steady *absolute* increase in their risk
- The most disadvantaged people are relatively unaffected by a recession. More than half of them are out of work in any case. About 1 in 10 adults are in this position of extreme disadvantage, who could hardly be further affected by temporary labour market fluctuations.

Notes

1. Between 2000 and 2004, the annual sample was based on financial years, for example April 2003 to March 2004, but they are labelled here according to the first-named year, for example 2003, for convenience. In 2005, the first three months of the calendar year were allocated to the 2004/05 survey (and labelled here 2004), while a new (and larger) sample was drawn for the remaining months (and labelled here 2005).
2. That is, 1974–2005, excluding 1977, 1978, 1997 and 1999.
3. The actual headline measure is based on all aged over 16, whereas the data in Figure 1 is based on the working age for a direct comparison with the GHS survey.
4. All the members of each year's GHS sample have identical values for the annual unemployment rate and the year. Estimates of sampling errors have taken account of the non-independence of these variables at the individual level by treating each year as a cluster.
5. It is interesting to note that while the raw trend in the non-employment rate is slightly negative in the first two columns of the table (without controls), it is slightly positive in the third column when characteristics are controlled for. This suggests that the reduction in overall non-work rates is more than accounted for by the reduction in the number of people with a high risk of non-employment in any case – for example people with no qualifications, and women with children.
6. The formula for predicting probabilities from a logistic regression equation is $1/(1+\exp(-x\beta))$ where $x\beta$ is the sum, for each member of the sample, of the values of the predictor variables times their coefficients.

CONTACT

Richard Berthoud, Institute for Social and Economic Research, University of Essex, Wivenhoe Park, Colchester CO4 3SQ.

berthoud@essex.ac.uk
0(44)1206 873982

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It is based mainly on GHS data collected by the Office for National Statistics and made available to analysts via the UK Data Archive.

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DISCLAIMER

The views expressed in this article are those of the author and do not necessarily represent those of the Office for National Statistics.

REFERENCES

Barham C, Walling A, Clancy G, Hicks S and Conn S (2009) 'Young people and the labour market', *Economic and Labour Market Review*, vol 3, no 4.

Beatty C and Fothergill S (2005) 'The diversion from unemployment to sickness across British regions and districts', *Regional Studies*, 39, pp. 837–854.

Berthoud R. (2008), 'Disability employment penalties in Britain', *Work, Employment and Society*, vol 22 no 1.

Berthoud R and Blekesaune M. (2007) *Persistent Employment Disadvantage*, DWP Research Report 416, Department for Work and Pensions.

Blekesaune M (2008), 'Unemployment and partnership dissolution', ISER Working Paper 2008–21, University of Essex.

Daily Telegraph (2009), 'Repossessions double in a year as a family loses their home every seven minutes', 22 January 2009.

Eslake S (2008) 'What is the difference between a recession and a depression?' available at: http://clubtroppo.com.au/2008/11/23/

Guardian (2009), 'Increase in burglaries shows effect of recession', 22 January 2009.

Independent (2008) 'Recession could put children at risk of abuse, warns Bar Council chief', 8 December.

Jones T (1993) *Britain's Ethnic Minorities*, Policy Studies Institute.

Muriel A and Sibieta L (2009), 'Living standards during previous recessions', IFS Briefing Note 85, Institute for Fiscal Studies.

NBER (2009) see www.nber.org/cycles.html#announcements

Smith D (1977) *Unemployment and Ethnic Minorities*, PEP.

Stafford B and Duffy D (2009) 'Review of evidence on the impact of economic downturn on disadvantaged groups', DWP Working Paper 68, Department for Work and Pensions.

Time (2009) 'Suicides: watching for a recession spike', 9 February 2009.

APPENDIX

Details of main logistic regression equation

Table A1 presents the details of a logistic regression equation predicting adults' probability of not working (at least 16 hour per week, using the definition explained in the main text in the section entitled 'Definitions of non-employment and unemployment'). The main coefficients show that, as expected, some types of people are systematically more or less likely to have a job than other types of people.

- Men and women without a partner have lower job expectations than men with a partner
- Over the period as a whole, women with a partner were even less likely to have a job than single people (though this disadvantage has decreased over the years)
- The younger a mother's, or lone father's, youngest child, the less likely s/he was to be employed
- The individual's own age had no effect on job chances up to 45; but expectations declined steadily from 45 onwards
- Disabled people were less likely to have a job
- The better someone's educational qualification, the more likely they were to be in employment
- Members or minority ethnic groups were often at a disadvantage. Pakistani and Bangladeshi women were exceptionally unlikely to have a job. In contrast, Caribbean women were more likely to have a job than white women with otherwise similar characteristics
- People living in some regions have less chance of being in work than in other regions, all other characteristics held constant

While these findings are of interest in their own right, showing which social groups are most and least disadvantaged, the task on this occasion is to show how the non-employment rates of each group changed from year to year, controlling for long-term trends in order to focus on short-term variations in the national unemployment rate. The logistic regression equation therefore included terms interacting all the 'social group' variables with both year-on-year trends and the annual unemployment rate. The coefficients on the interaction terms are shown on the right of Table A1.

Post-estimation commands were used to estimate, first, each sample member's current probability of being out of work and then each sample member's counterfactual probability of being out of work if the annual unemployment rate was increased by 3.3 per cent. The effect of a hypothesised recession is then the difference between the counterfactual prediction and the actual prediction. All the analysis in the article reports the effect in 2005, although in principle the same output could be applied to other years in the sequence.

The results of the analysis are shown in Table A1. The equation was based on 360,672 observations, clustered in 28 annual surveys, weighted as described in the main text. The ratios of coefficients to their standard errors are indicated by the z statistic, and coefficients significant at the 95 per cent confidence limit are highlighted in bold type. The pseudo R^2 (a measure of the accuracy with which the equation was able to predict individual non-work probabilities) was 25.4 per cent.

Table A1
Logistic regression equation estimating non-employment probabilities

		Main coefficient		Interactions with . . .					
	Mean (in			year		year squared		unemployment rate	
	2005)	B	z	B	z	B	z	B	z
Family structure									
Lone man	12%	**0.704**	11.2	–0.005	–0.3	0.000	–0.3	–0.006	–0.4
Man with partner (base)	38%								
Lone woman	15%	**1.721**	28.8	**–0.033**	–2.0	0.000	–0.3	**–0.064**	–4.1
Woman with partner	35%	**2.970**	37.2	**–0.049**	–3.5	0.000	0.1	**–0.084**	–5.7
Age of children[1]	–3	**–0.185**	–29.8	0.000	0.0	**0.000**	2.6	0.001	1.3
Has a working partner	53%	**–0.695**	–8.5	**–0.063**	–3.6	**0.002**	2.8	0.019	1.1
Age (spline)									
Per year, 20-45	37.6	**0.010**	2.5	**0.002**	3.2	**0.000**	–3.9	**–0.003**	–3.4
Per year, 45-59	2.7	**0.102**	27.8	0.001	1.9	0.000	–1.8	**–0.004**	–4.5
Disability									
None (base)	85%								
Limiting long-standing illness	15%	**1.118**	15.3	0.024	1.8	0.000	–0.4	**–0.036**	–2.4
Education									
No qualifications	14%	**0.145**	2.5	**0.037**	3.3	–0.001	–1.8	0.019	1.7
Less than O level/GCSE	9%	–0.082	–1.6	0.010	1.0	0.000	–0.6	**0.027**	2.7
GCSE (base)	23%								
A level	15%	**–0.145**	–2.4	0.004	0.3	0.000	–0.5	–0.013	–1.1
Higher	30%	**–0.442**	–7.7	–0.017	–1.8	0.000	1.5	0.010	1.0
Not known	8%	**0.571**	4.7	–0.030	–1.5	0.000	0.4	–0.007	–0.4
Ethnic group									
White (base)	90%								
Caribbean man	1%	0.138	0.9	0.037	1.3	–0.001	–0.6	0.012	0.4
Caribbean woman	1%	**–1.136**	–10.4						
Indian	3%	0.290	1.4	–0.028	–0.8	0.001	1.1	–0.009	–0.2
Pakistani/Bangladeshi man	1%	0.424	1.7	0.029	0.8	–0.001	–0.6	0.010	0.2
Pakistani/Bangladeshi woman	1%	**1.218**	5.3						
Other minority group	4%	–0.102	–0.5	0.023	0.8	0.000	0.1	–0.002	–0.1
Region									
Scotland	9%	–0.061	–1.1	**0.052**	6.0	**–0.002**	–5.4	–0.017	–1.6
North East	4%	**0.166**	3.8	**0.053**	3.6	**–0.002**	–3.5	–0.028	–1.9
North West	9%	0.010	0.2	0.015	1.3	–0.001	–1.4	0.004	0.3
Yorks & Humber	11%	**–0.116**	–2.2	**0.026**	2.9	**–0.001**	–2.4	0.000	0.0
East Midlands	8%	**–0.177**	–3.0	0.008	0.6	0.000	–0.4	0.016	1.0
West Midlands	9%	**–0.193**	–2.6	–0.010	–0.6	0.000	0.8	**0.036**	2.4
Wales	5%	**0.212**	3.8	0.020	1.7	**–0.001**	–2.2	–0.011	–0.9
Eastern	10%	–0.006	–0.1	0.000	0.0	0.000	–0.2	0.005	0.4
London	12%	**–0.230**	–4.0	0.014	1.3	0.000	–0.2	0.002	0.2
South East (base)	14%								
South West	9%	0.095	1.3	0.021	1.4	–0.001	–1.7	–0.011	–0.8
Trend									
Year	31	–0.045	–1.5						
Year squared	961	**0.003**	3.4						
Unemployment rate									
This year	0.033	**0.215**	7.0						
Constant		**–4.262**	–29.2						

Note: *Source: GHS and author's estimates*

1 Someone whose youngest child was aged 0 was scored -18; whose youngest child was 18, was scored 0. Women with no children were scored 0. Men were scored 0 unless they were lone parents.

ARTICLE

Jon Gough
Office for National Statistics

Discontinuity analysis affecting the 2006 ABI employee estimates

SUMMARY

Three changes to Annual Business Inquiry/1 were introduced to the 2006 survey which resulted in a discontinuity when comparing with previous years. This also affected Workforce Jobs (WFJ) estimates for employment as these figures are benchmarked against the ABI for certain sectors of the economy.

An impact assessment to measure the discontinuity has been completed. The main proposal, for users requiring a consistent time series, is to amend the back series for ABI/1 onto the new method. This can be done using link factors produced from the 2006 ABI/1 estimates on both the 'old' and 'new' methodology.

The overall discontinuity was estimated at 417,000 employees in a downward direction. The retail, real estate, education and health sectors were the industries affected the greatest.

The discontinuity for WFJ benchmarking is estimated to be 203,000 jobs in a downward direction. This is lower than the overall discontinuity because WFJ is not benchmarked to the ABI for all industries, and also because the change in reference date does not impact on WFJ due to benchmarking against the third quarter (September) estimates as opposed to the fourth quarter (December).

Background

In 2006, three improvements were introduced to the way employment estimates are formed from the Annual Business Inquiry (ABI). Two of these relate to the first phase of the transition to the Business Register Employment Survey (BRES), which will replace the ABI/1 in 2009 and bring various benefits to users. The 2006 ABI/1 represents an improvement to the detailed industry and regional employment estimates. The third change is a methodological improvement to the apportionment of the lower level estimates.

The three changes introduced were as follows:

- change in reference date from December to September
- use of Business Register Survey data within the ABI/1 results
- change to the minimum domain methodology

Further information on these changes can be found in the link: www.nomisweb.co.uk/articles/news/files/ABI%202006%20discontinuities.doc

At the time it was not possible to untangle the impact of the first two changes. Only a high level estimate could be produced, using an average of the revisions made to Workforce Jobs (WFJ) as part of the benchmarking process over past years.

Further analysis has now been concluded and the purpose of this paper is to provide information on the overall discontinuity caused by these three methodological changes.

Methodology

In order to identify the impact of the discontinuity, the results were re-run as close as possible to the old methodology wherever possible. It was not possible to re-estimate exactly on the old methods since the relevant data were not available. Each of the three changes were reviewed and removed separately in order to determine not just the overall impact, but also the impact of each change individually.

The order used to recreate the 2006 ABI/1 results on the 'old' methodology was to first remove the change in the minimum domain methodology, next the change in source data, and finally the change in the reference date. The order used to remove the discontinuity could potentially impact on the estimates of each of the contribution of each of the changes.

Change in the minimum domain methodology

The level at which the regional apportionment methodology was calculated was reviewed and improved for certain sectors. This change did not impact on the total number of employees but did affect the estimates at the detailed regional and industrial levels.

The results were processed on the previous regional apportionment methodology to identify the impact of the change. An assessment was published alongside the 2006 estimates, when they

were initially released via the Nomis website (this is a service provided by ONS giving access to the most detailed and up to date labour market statistics – www.nomisweb.co.uk).

Change in the source data

Prior to the 2006 change, if a business was selected for both the Short Term Employment Survey (STES) and ABI/1, then the ABI/1 questionnaire was suppressed and the STES return from the business used in the results. This was the case for most large (greater than 250 employees) businesses, although there were some smaller businesses included. This overlap control was changed in 2006 to allow the use of Business Register Survey (BRS) data returns within the ABI/1 results. This meant that for most large businesses BRS returns were used in place of STES. There are no definitional differences between surveys or, in theory, timing/reference date differences. The reason for the difference is mainly because STES is dispatched after BRS. Also STES collects turnover information (used for the short-term output indicators), and so businesses tend to wait until the turnover information is available before completing the employment section. This timing difference between the two surveys can lead to sizeable differences in the employment returns from the same businesses.

Where BRS data were used in the changed ABI results estimation process, they were matched to returns from STES. For successful matches, which was achieved for the majority of the larger businesses, the STES returns were taken into ABI to take the estimation process closer to the methodology used prior to the changes.

Change in the reference date

Prior to 2006, ABI/1 asked for employment on a set date in December. This was changed to a date in September for 2006.

To re-create figures at a December reference date non-seasonally adjusted WFJ employee estimates were used. WFJ collects and produces quarterly estimates from STES based on a set reference date. The reference date in September matches that of the ABI/1's changed (current) methodology and the reference date in December matched that of the ABI/1 under the previous method.

Using the WFJ estimates, a scaling factor was calculated at an industry level using the 2006 Q3 and 2006 Q4 estimates. These industry level factors were then applied to the relevant 2006 ABI/1 industry estimates to simulate the results on a December reference date.

Assumptions

When re-creating the results using the old methodology, several assumptions were made. These assumptions were:

- for cases where BRS returns were included in the ABI/1 results processing, because there was not a match with the STES sample, it was assumed the BRS return would match that which the ABI/1 return would have produced
- STES data validation would match ABI/1 validation. All STES data had been through validation procedures prior to inclusion in results. During ABI/1 construction extra validation by the ABI/1 team might have revised the figures. It was assumed this was not the case
- it was assumed that the general movement at industry level in the WFJ employee estimates between quarters was replicated across all the ABI/1 returns and aggregates

Analysis

This section reviews the results of reproducing the 2006 ABI estimates with the discontinuities removed. Analysis was undertaken at various levels with the summary of the results presented in the remainder of the article. Analysis was undertaken at the whole economy level and at 2-digit and 4-digit Standard Industrial Classification (SIC) levels. Regional results were produced and analysed at Government Office Region (GOR) and Local Authority level both by 2-digit SIC.

High level results

- the overall discontinuity introduced by the three changes to the ABI/1 is estimated to be 417,000 employees in a downward direction
- the introduction of the new methodology for Minimum Domains does not impact on the total number of employees
- the impact of the change in source data is estimated to be 190,000 employees in a downward direction
- the impact of the change in reference date is estimated to be 227,000 employees in a downward direction

Table 1 shows the estimates for the 2006 ABI at different stages of removing the total discontinuity.

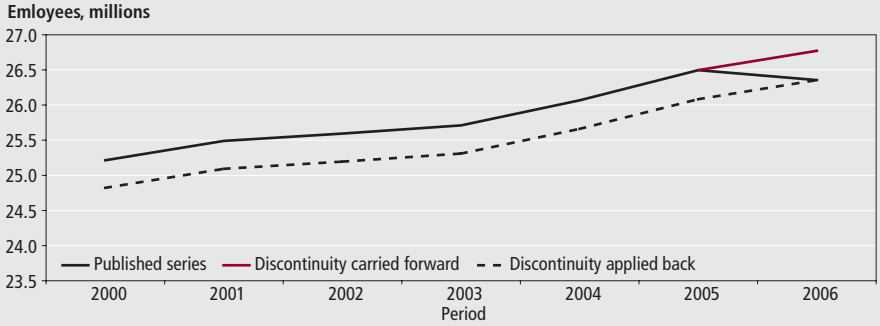
Figure 1 shows the published ABI employee figures from 2000 onwards together with estimates for 2006 with and without the total discontinuity removed.

Table 1
2006 employee estimates from the ABI with each discontinuity removed

Versions of Results	Number of Employees Estimate	Difference compared to the 'Published' Estimate
Published Estimate	26,335,000	
Removal of Minimum Domain methodology change	26,119,000	0
Removal of Minimum Domain methodology change & Source Data change	26,545,000	–190,000
Removal of Minimum Domain methodology change, Source Data change & Reference Date change	26,772,000	–417,000

Source: ABI/1

Figure 1
ABI/1 Time Series 2000–2006 including the impact of the discontinuity



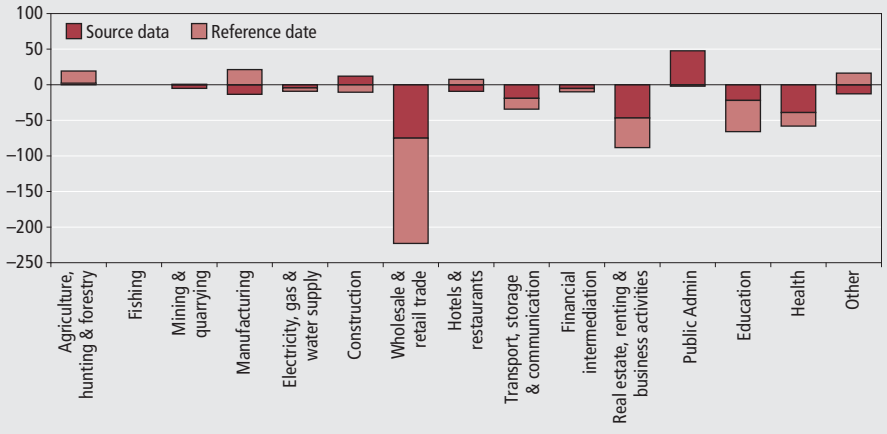
Source: ABI/1

Table 2
Impact of the discontinuity at sector level

Sector	Published Estimates	Estimates with discontinuity removed	Difference	Percentage difference
Agriculture, hunting & forestry	255,000	236,000	19,000	*7.5*
Fishing	7,000	7,000	0	*0.0*
Mining & quarrying	57,000	61,000	–4,000	*–7.0*
Manufacturing	2,869,000	2,861,000	8,000	*0.3*
Electricity, gas & water supply	101,000	110,000	–9,000	*–8.9*
Construction	1,259,000	1,257,000	2,000	*0.2*
Wholesale & retail trade	4,393,000	4,616,000	–223,000	*–5.1*
Hotels & restaurants	1,781,000	1,783,000	–2,000	*–0.1*
Transport, storage & communication	1,559,000	1,594,000	–35,000	*–2.2*
Financial intermediation	1,046,000	1,056,000	–10,000	*–1.0*
Real estate, renting & business activities	4,542,000	4,631,000	–89,000	*–2.0*
Public Admin	1,469,000	1,423,000	46,000	*3.1*
Education	2,411,000	2,477,000	–66,000	*–2.7*
Health	3,214,000	3,272,000	–58,000	*–1.8*
Other	1,393,000	1,390,000	3,000	*0.2*
Total	26,355,000	26,772,000	–417,000	*–1.6*

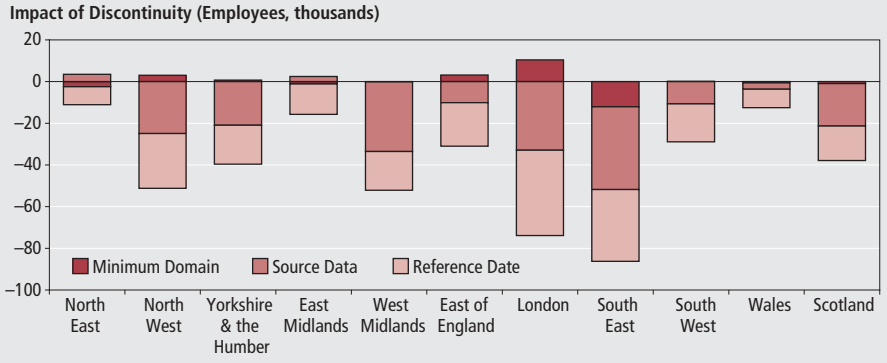
Source: ABI/1

Figure 2
Estimated discontinuity and impact of each change at Sector level



Source: ABI/1

Figure 3
Estimated discontinuity at Government Office Region (GOR) level



Source: ABI/1

The published series identifies the published figures on the number of employees from the ABI/1. The 'discontinuity carried forward' line highlights the figure for 2006, removing the methodological changes made. The 'discontinuity applied back' line provides an indication of the employee estimates for the back series using the new methodology. The recommended option, to have ABI/1 employee estimates on a consistent basis across the discontinuity, would be to amend the back series onto the new methodology. To do this a linking factor can be calculated, taking the published 2006 estimate divided by the estimate with the discontinuity removed for the required domain. This factor can then be applied to the relevant domain for previous periods. There are no plans for ONS to release a revised set of back data for ABI/1 estimates on this basis.

Industrial results

There were certain sectors of the economy that were affected to a greater degree than others. Also, each of the changes introduced had differing impacts on certain industries. The manufacturing sector was not affected to the same degree as the service sector. The overall discontinuity for the manufacturing sector was estimated to be 8,000 employees in an upward direction while for the service sector it is estimated to be 432,000 employees in a downward direction. The change in minimum domain did not impact at sector level for Great Britain as a whole. However, there was an impact at the more detailed industry level when analysing the overall discontinuity at the 2-digit and 4-digit SIC level. **Table 2** identifies the impact of the changes at the sector level. **Figure 2** shows the impact the changes in source data and reference date had on each sector.

The biggest impact was in highly seasonal industries, such as retail (division 52). This is due to the increase in the number of employees in the build up to the Christmas period. The change in reference date has the greatest impact but the change in source data (as detailed in the section on Methodology) also has an impact.

Breaking the sectors down into 2-digit industries (divisions) shows the largest difference was in retail (division 52) with an estimated discontinuity of –207,000. The main reason for this was the change in reference date, which accounted for approximately two-thirds of the whole discontinuity. Other divisions where

the changes introduced caused a large discontinuity were real estate (division 70 with –66,000), public administration (division 75 with 46,000), education (division 80 with –66,000) and health (division 85 with –58,000). The cause of the discontinuity varies between sectors.

There were certain divisions where the discontinuity was found to be small, but with sizeable impacts for the different changes that offset each other. An example of this was in 'Other business activities' (division 74). The overall discontinuity for this 2-digit SIC was estimated to be –26,000. However, the change in the minimum domain method accounted for an upward discontinuity of 47,000 and the changes in source data and the reference date an estimated downward discontinuity of 37,000 each.

Regional results

The changes made to the ABI also have an impact at regional as well as industry level. Analysis at Government Office Region (GOR) level shows that the area most affected was the South East of England with an estimated discontinuity of 86,000 in a downward direction. This is 2.3 per cent of the total estimated number of employees. The West Midlands was also impacted to a similar degree with 2.1 per cent, a discontinuity of 52,000 in a downward direction. The change in the minimum domain methodology had minimal impact at the overall GOR level, with the only noticeable impact being in London and the South East. The main reasons for the discontinuity were the changes in source data and reference date.

The impact at the overall GOR level and the contributions of each of the changes is shown in **Figure 3**.

Similar analysis was undertaken at the Local Authority (LA) level. There are 408 Local Authority districts throughout GB. Of these, 50 LAs showed a discontinuity of greater than 5 per cent with the largest being Castle Morpeth (15 per cent increase in employees due to the changes implemented) and Woking (17 per cent decrease).

Detailed ABI/1 estimates

Estimates for the ABI/1, including and excluding the discontinuity together with scaling factors to remove the discontinuity, can be found on the Nomis website at www.nomisweb.co.uk.

Impact on Workforce Jobs

WFJ estimates are benchmarked to the ABI/1 so the methodological changes have had an impact on these estimates. However, the overall level of discontinuity is not the same. The reference date change is not an issue as it is a matter of benchmarking to a different quarter. Also WFJ do not benchmark against the public sector component of the ABI/1.

The total discontinuity for WFJ was less than for the ABI/1 and was estimated to be 203,000 jobs in a downward direction.

ONS will reproduce estimates adjusting for the discontinuity at the same time WFJ statistics are published on a new industrial classification (SIC 2007), in June 2010, to avoid another release of revisions. The discontinuity will be removed from the employee jobs series by amending back series (pre 2006 Q3) like the recommended option for ABI/1 (see the 'discontinuity applied back' line in Figure 1). The difference will be wedged back to 1996 Q1, which is the start of the lowest level WFJ employee jobs series.

CONTACT

elmr@ons.gov.uk

Methods explained

Methods explained is a quarterly series of short articles explaining statistical issues and methodologies relevant to ONS and other data. As well as defining the topic areas, the notes explain why and how these methodologies are used. Where relevant, the reader is also pointed to further sources of information.

The quarterly alignment adjustment

Barry Williams
Office for National Statistics

SUMMARY

Gross Domestic Product (GDP), or the size of the economy, can be measured in three ways. These are the output, income and expenditure approaches. ONS routinely measures all three for the UK economy, but publishes a single 'coherent' estimate of GDP. This article explains the role of alignment adjustments in reconciling the output, income and expenditure data.

Estimates of the quarterly growth in the volume measure of Gross Domestic Product (GDP) are produced in each of the three months following the reference quarter. The preliminary estimate, published around 25 days after the reference quarter, is based on only partial information covering in total about 40 per cent of the components of economic output. The second and third vintages of quarterly GDP, published around 55 and 85 days after the reference quarter respectively, are based on more hard data and offer an expanded breakdown of activity by both industry and sector.

These second and third estimates are based on data for all three approaches of measuring economic activity, that is output, income and expenditure. The estimates based on the three measures are inevitably different, since they use a range of different data sources, and estimation methodologies. To provide users of GDP with a single 'coherent' estimate of GDP growth, ONS applies what is known as an alignment adjustment to bring the measures in line. In the UK the output measure is taken as the best short-term estimate of GDP growth, and so the other two measures are aligned to this. For GDP measured according to the income approach the alignment adjustment is applied to Gross Operating Surplus (GOS) of private non-financial corporations, and for GDP measured through the expenditure approach the alignment adjustment is applied to the Change in Inventories component.

Short-term GDP estimation and the introduction of the alignment adjustment

The history of modern GDP data production in the UK can essentially be pivoted around the Pickford Report (Government Economic Statistics: A Scrutiny Report; 1989), which made widespread recommendations for the process and presentation of data within the UK. It resulted in a number of methodological improvements within the National Accounts, including the introduction of new short-term turnover surveys which vastly improved the coverage of the service sector. This process facilitated the introduction of the preliminary estimate of GDP in April 1993 (for Q1 1993) and highlighted the need for an aligned estimate in the production of the second and third estimates. Until this point the three approaches were presented as individual estimates with no attempt to establish a consistent growth rate. Instead, the simple average of the three separate estimates was published.

It is relatively easy to highlight the weakness of applying equal weights to each of the three methods of measuring GDP when compiling an 'average' headline figure (while also providing the three estimates in their own right). We can plot a 'real time' estimate of the annual growth rate of GDP by each measure from 1980-1991, showing the provisional estimates of GDP - taken from the Central Statistics Office (CSO) Economic Trends release (a forerunner to this journal). These growth rates are given at factor cost, rather than market price but serve to illustrate the vast divergences which can exist in any given quarter and how this might feed through into policy and analysis (see **Figure 1**).

The data presented do not represent a time-series as such, but a snap-shot of the first available income, expenditure and output data as would have been witnessed by government and other interested bodies on a real-time basis.

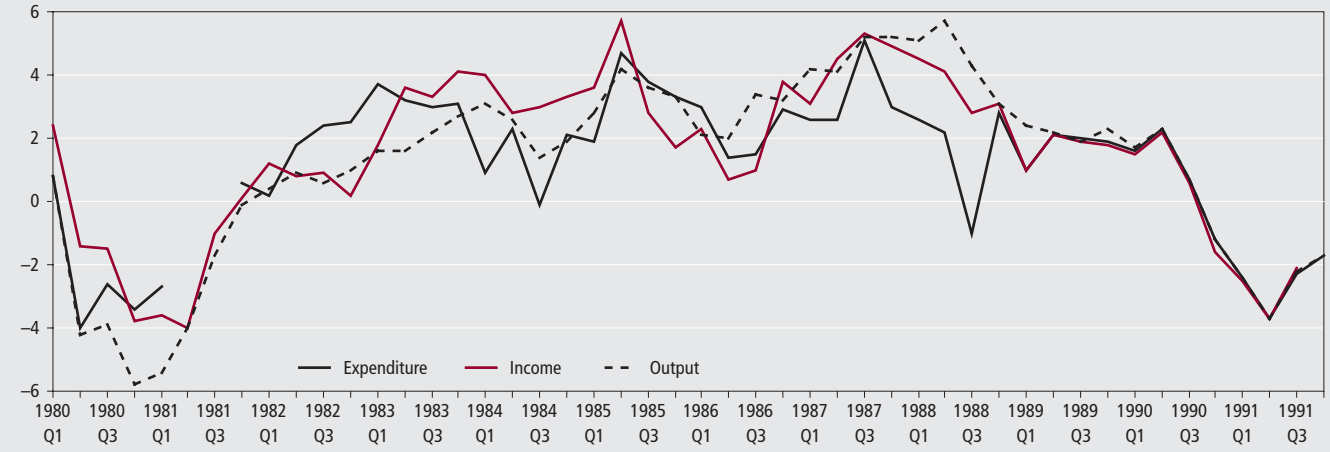
Considering the period in the immediate run up to the review of government statistics, the divergence between the three measures is apparent. For example, through the first two quarters of 1988, GDP from the output approach was growing at over 5 per cent on the same quarter in 1987, whilst from the income approach growth averaged over 4 per cent. Both these results represented a performance well beyond the estimated trend growth for the economy at the time (estimated by the Treasury at around 2.5 per cent at the time of the 2009 Budget). Over the same period however, expenditure data reported growth around trend, between 2-3 percentage points below the other measures.

If we examine the divergence between the three measures in 1988 quarter three, we highlight the need to apply some preferential ordering of the relative qualities of these measures.

Taking a simple average of the growth rates, GDP was expanding at around 2 per cent on a four quarter basis, however, the output measure of growth was 4.3 per cent and the expenditure measure was -1 per cent.

The nature of the divergence between the three series is not

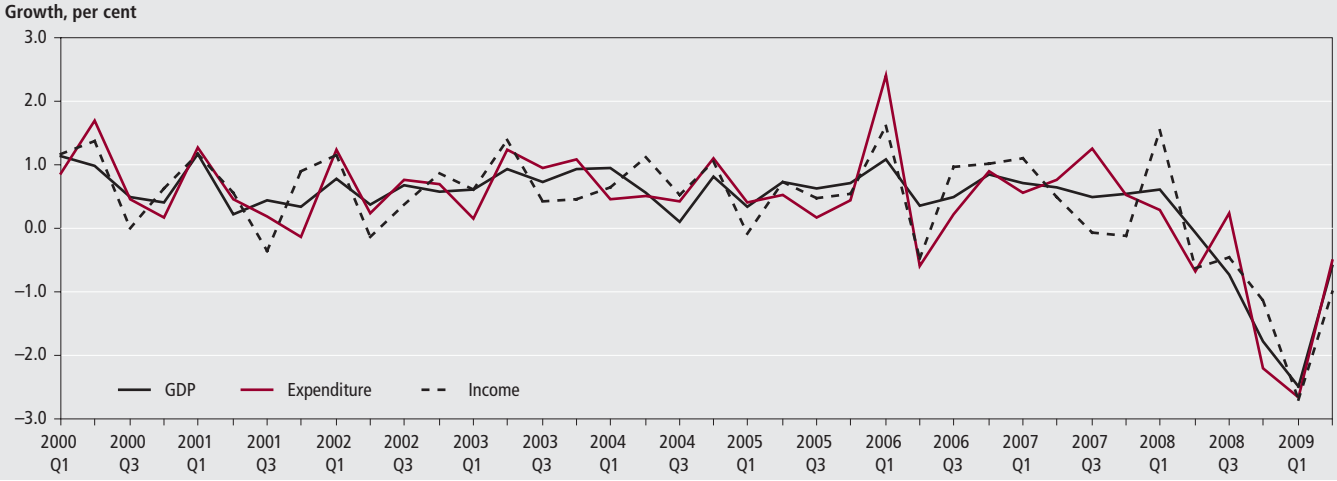
Figure 1
Unaligned GDP estimates 1980–1991



Note: *Source: Economic Trends*

1 The gap in expenditure data between 1981 Q1 and 1981 Q4 was due to industrial action.

Figure 2
Unaligned growth series against aligned series



Source: Economic Trends

consistent over the observed period. It was not evident that any one of the measures was 'always' stronger or weaker than any other and as such there does not appear to be any repeated bias or constant gap between the measures.

Short-term GDP measures and the alignment adjustment

To make a meaningful alignment adjustment, there must be a statistical reason for supporting one approach to measurement of GDP in advance of the other two. If we consider the process behind quarterly GDP estimates we will be able to explain the rationale behind ONS's approach to aligning the UK output, income and expenditure release (second estimate of GDP growth in the reference period) and the Quarterly National Accounts a month later.

The preliminary estimate of GDP is based mostly upon short-term turnover surveys of the production and service industries (around 93 per cent of output taken in combination). The other major component is the construction sector (around 6 per cent) and is based upon Experian survey data. There are data for the first two months of the quarter whilst the final month has a high forecast element and as such will be subject to revision as additional information becomes available. Overall, the proportion of information based upon actual data at the time of the preliminary estimate is just over 40 per cent.

By the time of the second estimate, turnover data covering the final month of the reference period is available. At this time, there is also around 50-60 percent data content available to produce estimates of GDP from the expenditure and income approaches. Consequently, a provisional set of estimates for all three approaches and revisions to the initial estimates of output figures can be made. It is worth noting that the most recent quarter is the only one open to revision during this stage of the estimation process.

At the Quarterly National Accounts release (the final quarterly estimate) a more detailed set of sectoral accounts data are produced, taking on revisions to previous quarters as well as the present quarter (with the current and previous year open for revision). There are more data available on the expenditure and income sides, much of which are supplied by household and firm based labour market and expenditure surveys as well as other government departments and

organisations. The Experian construction data have been replaced by the ONS output in the construction industry data produced on a national accounts basis (and as such not identical to the separate construction release). Overall, the data content of output is over 90 percent at this stage of estimation, with expenditure estimates representing just under 90 percent data and income data content of just over 70 percent.

It is apparent that the actual data content of the output measure is greater than the other two approaches and as such it has lower forecast content. But greater than this, output is a more stable indicator of short-term growth, with fewer erratic components than the income and expenditure approaches.

It is also the case that the data content and detail provided in the first estimate is limited, this is the trade-off inherent in producing a timely measure of GDP and as such there is an inevitable potential for revision as forecasts are replaced by data.

The alignment adjustment is applied to the individual components of income and expenditure which are subject to the highest level of data uncertainty. This approach is easier and requires fewer assumptions than applying the adjustments on an ad hoc basis to the individual components. Ad hoc data adjustments will generally be applied where there are obvious anomalous data errors in survey responses or known factors which require an adjustment (known underlying survey quality issues). As such the alignment adjustment is the final stage in producing a coherent set of quarterly accounts, offering a single growth rate for policy makers.

As stated above, the alignment adjustment is applied to smooth the path of growth for income and expenditure measures of GDP in line with output. This smoothing effect can be demonstrated by considering the aligned growth rate in GDP against that where the alignment adjustment has been stripped from the two measures shown in **Figure 2**.

The adjustment is applied to equate the following;

$$[GDP(O)_t / GDP(O)_{t-1}] - 1$$
$$= [GDP(E)_t / GDP(E)_{t-1}] - 1$$
$$= [GDP(I)_t / GDP(I)_{t-1}] - 1$$

At the time of the Output, Income and Expenditure release this is an adjustment to the level of GDP in the current period. At the time of Quarterly National Accounts when the current and previous year are open to revisions, the extra data taken on and adjustments made are such that the alignment can change in t-i as well as at time t. It is at this point that the process of aligning to output growth but also smoothing is carried out whilst constraining the overall series to a zero alignment adjustment on an annual basis. This smoothing approach also avoids the problem of any large level shifts between quarter four and quarter one figures across years, which simpler growth alignment might cause.

The two components where alignment is applied are the change in inventories series for expenditure and the gross operating surplus of the private non-financial corporation (PNFC) sector in the income data.

GOS is broadly representative of the profits made by commercial enterprises. The estimate of GOS is derived as the residual between the total of remuneration of employees and operating costs and the total income accrued from production (after addition of taxes and less subsidies). It does not include net property income and excludes holding gains from the process of accruing inventories.

The data content of operating income is quite low at the second estimate of GDP and it is not until the annual administrative and business survey data become available that a firm data set emerges. It is the area with the highest degree of data uncertainty and is therefore used as the component where the alignment adjustment will be applied.

From the perspective of expenditure measure of GDP, the change in inventories is calculated from the quarterly stocks inquiry and is based on the difference between the opening and closing 'book value' of inventory holdings. These holdings are then adjusted to remove any holding gains which may have accrued during the quarter (reflecting changes in the valuation of stocks) and then deflated to account for price movements. This leads to a volume measure of the change in inventories over the quarter.

The quarterly alignment adjustment is constrained to sum to zero over the course of a calendar year. It therefore serves the purpose of smoothing the quarterly paths of income and expenditure to bring them in line with the output estimates without impacting upon the annual totals. As data content improves, the quarterly alignment adjustment is generally reduced. This is because incomplete data and forecast estimates or proxy measures are replaced by full survey information and more precise administrative data.

The alignment applied to GOS and change in inventories series are published at Quarterly National Accounts (Table M) allowing the calculation of an unaligned estimate. These unaligned estimates however, are obviously not consistent with the headline figure for the whole economy.

As the alignment adjustment is applied to bring growth rates of income and expenditure measures into line with output (not levels) and because the adjustment is constrained to sum to zero over the course of a calendar year there will generally be a statistical discrepancy between the levels of the three series for years which have not undergone the blue book balancing process. This statistical discrepancy amounted to a £1.4 billion negative adjustment to expenditure (in constant prices) for 2008 and adds up to a £1.6 billion negative adjustment for the year to date (up to quarter three) in 2009.

CONTACT

elmr@ons.gsi.gov.uk

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Key time series

1 National accounts aggregates

Last updated: 25/11/09

Seasonally adjusted

	£ million		Indices (2005 = 100)						
	At current prices		Value indices at current prices		Chained volume indices			Implied deflators[3]	
	Gross domestic product (GDP) at market prices	Gross value added (GVA) at basic prices	GDP at market prices[1]	GVA at basic prices	Gross national disposable income at market prices[2]	GDP at market prices	GVA at basic prices	GDP at market prices	GVA at basic prices
	YBHA	ABML	YBEU	YBEX	YBFP	YBEZ	CGCE	YBGB	CGBV
2004	1,202,956	1,070,951	95.9	95.9	98.4	97.9	97.7	98.0	98.2
2005	1,254,058	1,116,648	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2006	1,325,795	1,181,141	105.7	105.8	101.7	102.9	103.0	102.8	102.7
2007	1,398,882	1,245,735	111.5	111.6	105.4	105.5	105.7	105.7	105.6
2008	1,448,054	1,298,497	115.5	116.3	106.7	106.1	106.3	108.9	109.4
2004 Q1	294,112	261,280	93.8	93.6	97.9	97.2	96.9	96.5	96.5
2004 Q2	299,142	265,977	95.4	95.3	98.0	97.8	97.6	97.6	97.6
2004 Q3	302,115	269,503	96.4	96.5	97.8	97.9	97.7	98.5	98.8
2004 Q4	307,587	274,191	98.1	98.2	100.0	98.7	98.5	99.5	99.7
2005 Q1	308,723	274,756	98.5	98.4	99.6	99.0	99.0	99.5	99.4
2005 Q2	313,479	279,258	100.0	100.0	101.1	99.7	99.7	100.3	100.3
2005 Q3	313,378	278,669	100.0	99.8	99.2	100.3	100.3	99.6	99.6
2005 Q4	318,478	283,965	101.6	101.7	100.0	101.0	101.0	100.6	100.7
2006 Q1	326,085	291,002	104.0	104.2	101.2	102.1	102.2	101.9	102.0
2006 Q2	327,836	291,886	104.6	104.6	101.5	102.5	102.6	102.0	101.9
2006 Q3	333,542	297,046	106.4	106.4	101.8	103.0	103.1	103.3	103.2
2006 Q4	338,332	301,207	107.9	107.9	102.3	103.8	104.0	103.9	103.8
2007 Q1	344,238	306,154	109.8	109.7	103.6	104.6	104.7	105.0	104.7
2007 Q2	348,010	309,585	111.0	110.9	104.7	105.2	105.4	105.5	105.2
2007 Q3	351,635	313,159	112.2	112.2	105.1	105.8	106.0	106.0	105.8
2007 Q4	354,999	316,837	113.2	113.5	108.0	106.3	106.6	106.5	106.5
2008 Q1	363,091	324,131	115.8	116.1	109.0	107.0	107.4	108.3	108.1
2008 Q2	363,228	323,898	115.9	116.0	107.9	106.9	107.3	108.4	108.1
2008 Q3	362,061	325,405	115.5	116.6	106.4	106.1	106.3	108.8	109.7
2008 Q4	359,674	325,063	114.7	116.4	103.7	104.2	104.3	110.1	111.6
2009 Q1	348,971	316,345	111.3	113.3	102.1	101.6	101.7	109.5	111.4
2009 Q2	346,951	314,330	110.7	112.6	99.2	101.0	101.1	109.5	111.4
2009 Q3	350,483	316,595	111.8	113.4		100.7	100.9	111.0	112.5

Percentage change, quarter on corresponding quarter of previous year

			IHYO	ABML[4]	YBGO[4]	IHYR	ABMM[4]	IHYU	ABML/ABMM[4]
2004 Q1	*5.7*	*5.4*	*5.7*	*5.4*	*3.0*	*3.6*	*3.4*	*2.0*	*1.9*
2004 Q2	*5.6*	*5.3*	*5.6*	*5.3*	*3.4*	*3.2*	*3.2*	*2.3*	*2.1*
2004 Q3	*5.2*	*5.4*	*5.2*	*5.4*	*2.5*	*2.6*	*2.6*	*2.6*	*2.8*
2004 Q4	*5.7*	*5.9*	*5.7*	*5.9*	*3.0*	*2.4*	*2.4*	*3.1*	*3.4*
2005 Q1	*5.0*	*5.2*	*5.0*	*5.2*	*1.8*	*1.8*	*2.1*	*3.1*	*3.0*
2005 Q2	*4.8*	*5.0*	*4.8*	*5.0*	*3.2*	*2.0*	*2.2*	*2.8*	*2.7*
2005 Q3	*3.7*	*3.4*	*3.7*	*3.4*	*1.4*	*2.5*	*2.6*	*1.2*	*0.7*
2005 Q4	*3.5*	*3.6*	*3.5*	*3.6*	*0.0*	*2.4*	*2.6*	*1.1*	*1.0*
2006 Q1	*5.6*	*5.9*	*5.6*	*5.9*	*1.6*	*3.2*	*3.2*	*2.4*	*2.6*
2006 Q2	*4.6*	*4.5*	*4.6*	*4.5*	*0.4*	*2.8*	*2.9*	*1.7*	*1.5*
2006 Q3	*6.4*	*6.6*	*6.4*	*6.6*	*2.6*	*2.7*	*2.9*	*3.7*	*3.6*
2006 Q4	*6.2*	*6.1*	*6.2*	*6.1*	*2.3*	*2.8*	*2.9*	*3.3*	*3.1*
2007 Q1	*5.6*	*5.2*	*5.6*	*5.2*	*2.3*	*2.4*	*2.5*	*3.1*	*2.7*
2007 Q2	*6.2*	*6.1*	*6.2*	*6.1*	*3.1*	*2.7*	*2.7*	*3.4*	*3.3*
2007 Q3	*5.4*	*5.4*	*5.4*	*5.4*	*3.3*	*2.7*	*2.8*	*2.6*	*2.5*
2007 Q4	*4.9*	*5.2*	*4.9*	*5.2*	*5.6*	*2.4*	*2.6*	*2.5*	*2.6*
2008 Q1	*5.5*	*5.9*	*5.4*	*5.9*	*5.3*	*2.2*	*2.6*	*3.1*	*3.2*
2008 Q2	*4.4*	*4.6*	*4.3*	*4.6*	*3.0*	*1.5*	*1.8*	*2.8*	*2.8*
2008 Q3	*3.0*	*3.9*	*3.0*	*3.9*	*1.2*	*0.3*	*0.3*	*2.6*	*3.6*
2008 Q4	*1.3*	*2.6*	*1.4*	*2.6*	*–4.0*	*–1.9*	*–2.2*	*3.4*	*4.9*
2009 Q1	*–3.9*	*–2.4*	*–3.9*	*–2.4*	*–6.3*	*–5.0*	*–5.3*	*1.2*	*3.0*
2009 Q2	*–4.5*	*–3.0*	*–4.5*	*–3.0*	*–8.1*	*–5.5*	*–5.8*	*1.1*	*3.0*
2009 Q3	*–3.2*	*–2.7*	*–3.2*	*–2.7*		*–5.1*	*–5.1*	*2.0*	*2.6*

Notes:

Source: Office for National Statistics

1 "Money GDP".
2 This series is only updated once a quarter, in line with the full quarterly national accounts data set.
3 Based on chained volume measures and current price estimates of expenditure components of GDP.
4 Derived from these identification (CDID) codes.

2 Gross domestic product: by category of expenditure

Last updated: 25/11/09

£ million, chained volume measures, reference year 2005, seasonally adjusted

	Domestic expenditure on goods and services at market prices											
	Final consumption expenditure			Gross capital formation								
	Households	Non-profit institutions[1]	General government	Gross fixed capital formation	Changes in inventories[2]	Acquisitions less disposals of valuables	Total	Exports of goods and services	Gross final expenditure	*less* imports of goods and services	Statistical discrepancy (expenditure)	Gross domestic at product market prices
	ABJR	HAYO	NMRY	NPQT	CAFU	NPJR	YBIM	IKBK	ABMG	IKBL	GIXS	ABMI
2004	766,856	30,827	262,917	204,756	4,843	–39	1,270,173	306,582	1,576,497	348,894	0	1,227,387
2005	784,140	30,824	268,088	209,758	4,472	–377	1,296,905	330,794	1,627,699	373,641	0	1,254,058
2006	795,595	31,868	272,271	223,305	4,789	304	1,328,132	368,076	1,696,207	406,374	0	1,289,833
2007	815,157	30,040	275,488	240,613	6,646	562	1,368,506	357,677	1,726,183	403,341	0	1,322,842
2008	822,335	30,941	282,333	232,660	866	1,295	1,370,430	361,149	1,731,578	400,033	–1,428	1,330,118
2004 Q1	189,235	7,875	65,615	50,706	515	–113	314,855	74,389	389,121	84,284	0	304,784
2004 Q2	191,672	7,737	65,323	51,680	294	65	316,727	76,058	392,705	86,139	0	306,510
2004 Q3	192,642	7,664	65,746	51,351	953	8	317,863	76,895	394,700	87,840	0	306,806
2004 Q4	193,307	7,551	66,233	51,019	3,081	1	320,728	79,240	399,971	90,631	0	309,287
2005 Q1	194,294	7,745	66,418	51,092	2,978	–45	322,029	77,762	399,757	89,398	0	310,313
2005 Q2	195,610	7,676	66,986	51,273	2,025	90	323,588	80,830	404,405	91,846	0	312,550
2005 Q3	196,450	7,687	67,265	53,964	–251	–292	325,046	84,250	409,304	94,834	0	314,490
2005 Q4	197,786	7,716	67,419	53,429	–280	–130	326,242	87,952	414,233	97,563	0	316,705
2006 Q1	197,278	7,941	67,862	53,372	2,346	106	328,906	95,835	424,741	104,616	0	320,125
2006 Q2	199,392	8,025	67,692	54,499	63	241	329,912	97,932	427,844	106,555	0	321,289
2006 Q3	198,692	8,012	68,232	56,780	1,679	–30	333,365	86,854	420,220	97,364	0	322,855
2006 Q4	200,233	7,890	68,485	58,654	701	–13	335,949	87,455	423,402	97,839	0	325,564
2007 Q1	202,299	7,447	68,394	59,659	928	76	338,804	88,279	427,083	99,211	0	327,872
2007 Q2	203,492	7,413	68,650	59,620	–12	348	339,510	88,650	428,160	98,193	0	329,967
2007 Q3	204,321	7,471	69,165	59,777	3,130	45	343,909	90,348	434,256	102,647	0	331,609
2007 Q4	205,045	7,709	69,279	61,557	2,600	93	346,283	90,400	436,684	103,290	0	333,394
2008 Q1	206,760	7,721	69,838	59,347	3,390	212	347,268	91,126	438,394	102,734	–247	335,412
2008 Q2	206,485	7,815	70,365	59,635	725	436	345,462	91,839	437,302	101,811	–328	335,163
2008 Q3	205,766	7,752	70,714	57,462	640	366	342,701	90,933	433,635	100,503	–398	332,733
2008 Q4	203,324	7,653	71,416	56,216	–3,889	281	334,999	87,251	422,247	94,985	–455	326,810
2009 Q1	200,326	7,411	71,470	52,105	–5,171	279	326,421	81,065	407,485	88,320	–507	318,659
2009 Q2	199,128	7,223	71,896	49,378	–4,110	280	323,796	79,935	403,731	86,398	–543	316,790
2009 Q3	199,097	7,081	72,065	49,244	–4,144	234	323,577	80,332	403,910	87,500	–569	315,841

Percentage change, quarter on corresponding quarter of previous year

										IHYR
2004 Q1	*3.4*	*1.6*	*4.7*	*3.8*		*4.4*	*0.2*	*3.5*	*3.3*	*3.6*
2004 Q2	*3.3*	*0.7*	*3.2*	*7.4*		*3.9*	*5.3*	*4.2*	*7.6*	*3.2*
2004 Q3	*3.2*	*–0.6*	*2.6*	*7.1*		*3.1*	*6.8*	*3.8*	*8.5*	*2.6*
2004 Q4	*3.0*	*–2.1*	*1.7*	*2.3*		*2.7*	*7.9*	*3.7*	*8.4*	*2.4*
2005 Q1	*2.7*	*–1.7*	*1.2*	*0.8*		*2.3*	*4.5*	*2.7*	*6.1*	*1.8*
2005 Q2	*2.1*	*–0.8*	*2.5*	*–0.8*		*2.2*	*6.3*	*3.0*	*6.6*	*2.0*
2005 Q3	*2.0*	*0.3*	*2.3*	*5.1*		*2.3*	*9.6*	*3.7*	*8.0*	*2.5*
2005 Q4	*2.3*	*2.2*	*1.8*	*4.7*		*1.7*	*11.0*	*3.6*	*7.6*	*2.4*
2006 Q1	*1.5*	*2.5*	*2.2*	*4.5*		*2.1*	*23.2*	*6.2*	*17.0*	*3.2*
2006 Q2	*1.9*	*4.5*	*1.1*	*6.3*		*2.0*	*21.2*	*5.8*	*16.0*	*2.8*
2006 Q3	*1.1*	*4.2*	*1.4*	*5.2*		*2.6*	*3.1*	*2.7*	*2.7*	*2.7*
2006 Q4	*1.2*	*2.3*	*1.6*	*9.8*		*3.0*	*–0.6*	*2.2*	*0.3*	*2.8*
2007 Q1	*2.5*	*–6.2*	*0.8*	*11.8*		*3.0*	*–7.9*	*0.6*	*–5.2*	*2.4*
2007 Q2	*2.1*	*–7.6*	*1.4*	*9.4*		*2.9*	*–9.5*	*0.1*	*–7.8*	*2.7*
2007 Q3	*2.8*	*–6.8*	*1.4*	*5.3*		*3.2*	*4.0*	*3.3*	*5.4*	*2.7*
2007 Q4	*2.4*	*–2.3*	*1.2*	*4.9*		*3.1*	*3.4*	*3.1*	*5.6*	*2.4*
2008 Q1	*2.2*	*3.7*	*2.1*	*–0.5*		*2.5*	*3.2*	*2.6*	*3.6*	*2.3*
2008 Q2	*1.5*	*5.4*	*2.5*	*0.0*		*1.8*	*3.6*	*2.1*	*3.7*	*1.6*
2008 Q3	*0.7*	*3.8*	*2.2*	*–3.9*		*–0.4*	*0.6*	*–0.1*	*–2.1*	*0.3*
2008 Q4	*–0.8*	*–0.7*	*3.1*	*–8.7*		*–3.3*	*–3.5*	*–3.3*	*–8.0*	*–2.0*
2009 Q1	*–3.1*	*–4.0*	*2.3*	*–12.2*		*–6.0*	*–11.0*	*–7.1*	*–14.0*	*–5.0*
2009 Q2	*–3.6*	*–7.6*	*2.2*	*–17.2*		*–6.3*	*–13.0*	*–7.7*	*–15.1*	*–5.5*
2009 Q3	*–3.2*	*–8.7*	*1.9*	*–14.3*		*–5.6*	*–11.7*	*–6.9*	*–12.9*	*–5.1*

Notes:

Source: Office for National Statistics

1 Non-profit institutions serving households (NPISH).
2 This series includes a quarterly alignment adjustment.

3 Labour market summary

Last updated: 11/11/09

United Kingdom (thousands), seasonally adjusted

	All aged 16 and over								
	All	Total economically active	Total in employment	Unemployed	Economically inactive	Economic activity rate (%)	Employment rate (%)	Unemployment rate (%)	Economic inactivity rate (%)
	1	2	3	4	5	6	7	8	9
All persons	MGSL	MGSF	MGRZ	MGSC	MGSI	MGWG	MGSR	MGSX	YBTC
Jul–Sep 2007	48,724	30,928	29,281	1,647	17,796	*63.5*	*60.1*	*5.3*	*36.5*
Jul–Sep 2008	49,133	31,249	29,417	1,832	17,885	*63.6*	*59.9*	*5.9*	*36.4*
Oct–Dec 2008	49,228	31,326	29,323	2,003	17,902	*63.6*	*59.6*	*6.4*	*36.4*
Jan–Mar 2009	49,323	31,395	29,168	2,227	17,928	*63.7*	*59.1*	*7.1*	*36.3*
Apr–Jun 2009	49,418	31,353	28,921	2,432	18,065	*63.4*	*58.5*	*7.8*	*36.6*
Jul–Sep 2009	49,515	31,389	28,927	2,461	18,127	*63.4*	*58.4*	*7.8*	*36.6*
Male	MGSM	MGSG	MGSA	MGSD	MGSJ	MGWH	MGSS	MGSY	YBTD
Jul–Sep 2007	23,698	16,793	15,854	939	6,905	*70.9*	*66.9*	*5.6*	*29.1*
Jul–Sep 2008	23,924	16,959	15,879	1,080	6,965	*70.9*	*66.4*	*6.4*	*29.1*
Oct–Dec 2008	23,975	17,008	15,806	1,202	6,967	*70.9*	*65.9*	*7.1*	*29.1*
Jan–Mar 2009	24,025	17,025	15,681	1,345	7,000	*70.9*	*65.3*	*7.9*	*29.1*
Apr–Jun 2009	24,076	16,972	15,482	1,490	7,104	*70.5*	*64.3*	*8.8*	*29.5*
Jul–Sep 2009	24,129	16,956	15,432	1,524	7,173	*70.3*	*64.0*	*9.0*	*29.7*
Female	MGSN	MGSH	MGSB	MGSE	MGSK	MGWI	MGST	MGSZ	YBTE
Jul–Sep 2007	25,025	14,135	13,427	708	10,891	*56.5*	*53.7*	*5.0*	*43.5*
Jul–Sep 2008	25,210	14,290	13,538	752	10,920	*56.7*	*53.7*	*5.3*	*43.3*
Oct–Dec 2008	25,254	14,318	13,517	801	10,936	*56.7*	*53.5*	*5.6*	*43.3*
Jan–Mar 2009	25,298	14,370	13,487	882	10,928	*56.8*	*53.3*	*6.1*	*43.2*
Apr–Jun 2009	25,342	14,381	13,439	942	10,961	*56.7*	*53.0*	*6.5*	*43.3*
Jul–Sep 2009	25,386	14,433	13,495	937	10,953	*56.9*	*53.2*	*6.5*	*43.1*

	All aged 16 to 59/64								
	All	Total economically active	Total in employment	Unemployed	Economically inactive	Economic activity rate (%)	Employment rate (%)	Unemployment rate (%)	Economic inactivity rate (%)
	10	11	12	13	14	15	16	17	18
All persons	YBTF	YBSK	YBSE	YBSH	YBSN	MGSO	MGSU	YBTI	YBTL
Jul–Sep 2007	37,588	29,662	28,038	1,624	7,926	*78.9*	*74.6*	*5.5*	*21.1*
Jul–Sep 2008	37,758	29,893	28,090	1,804	7,865	*79.2*	*74.4*	*6.0*	*20.8*
Oct–Dec 2008	37,806	29,951	27,979	1,972	7,855	*79.2*	*74.0*	*6.6*	*20.8*
Jan–Mar 2009	37,853	30,011	27,817	2,194	7,843	*79.3*	*73.5*	*7.3*	*20.7*
Apr–Jun 2009	37,900	29,944	27,547	2,397	7,956	*79.0*	*72.7*	*8.0*	*21.0*
Jul–Sep 2009	37,946	29,949	27,524	2,425	7,997	*78.9*	*72.5*	*8.1*	*21.1*
Male	YBTG	YBSL	YBSF	YBSI	YBSO	MGSP	MGSV	YBTJ	YBTM
Jul–Sep 2007	19,571	16,366	15,435	931	3,205	*83.6*	*78.9*	*5.7*	*16.4*
Jul–Sep 2008	19,708	16,507	15,440	1,066	3,202	*83.8*	*78.3*	*6.5*	*16.2*
Oct–Dec 2008	19,737	16,551	15,361	1,189	3,186	*83.9*	*77.8*	*7.2*	*16.1*
Jan–Mar 2009	19,765	16,576	15,246	1,331	3,189	*83.9*	*77.1*	*8.0*	*16.1*
Apr–Jun 2009	19,794	16,522	15,047	1,475	3,272	*83.5*	*76.0*	*8.9*	*16.5*
Jul–Sep 2009	19,821	16,489	14,982	1,507	3,332	*83.2*	*75.6*	*9.1*	*16.8*
Female	YBTH	YBSM	YBSG	YBSJ	YBSP	MGSQ	MGSW	YBTK	YBTN
Jul–Sep 2007	18,017	13,296	12,603	692	4,721	*73.8*	*70.0*	*5.2*	*26.2*
Jul–Sep 2008	18,050	13,387	12,650	737	4,663	*74.2*	*70.1*	*5.5*	*25.8*
Oct–Dec 2008	18,069	13,400	12,618	782	4,669	*74.2*	*69.8*	*5.8*	*25.8*
Jan–Mar 2009	18,088	13,434	12,571	863	4,654	*74.3*	*69.5*	*6.4*	*25.7*
Apr–Jun 2009	18,107	13,422	12,500	922	4,684	*74.1*	*69.0*	*6.9*	*25.9*
Jul–Sep 2009	18,125	13,460	12,542	918	4,665	*74.3*	*69.2*	*6.8*	*25.7*

Notes:

Relationship between columns: 1 = 2 + 5; 2 = 3 + 4; 6 = 2/1; 7 = 3/1; 8 = 4/2; 9 = 5/1; 10 = 11 + 14; 11 = 12 + 13; 15 = 11/10; 16 = 12/10; 17 = 13/11; 18 = 14/10

The Labour Force Survey is a survey of the population of private households, student halls of residence and NHS accommodation.

Source: Labour Force Survey, Office for National Statistics

Labour Market Statistics Helpline: 01633 456901

4 Prices

Last updated: 17/11/09

Percentage change over 12 months

Not seasonally adjusted

	Consumer prices						Producer prices			
	Consumer prices index (CPI)			Retail prices index (RPI)			Output prices		Input prices	
	All items	CPI excluding indirect taxes (CPIY)[1]	CPI at constant tax rates (CPI-CT)	All items	All items excluding mortgage interest payments (RPIX)	All items excluding mortgage interest payments and indirect taxes (RPIY)[2]	All manufactured products	Excluding food, beverages, tobacco and petroleum products	Materials and fuels purchased by manufacturing industry	Excluding food, beverages, tobacco and petroleum products
	D7G7	EL2S	EAD6	CZBH	CDKQ	CBZX	PLLU[3]	PLLV[3,4]	RNNK[3,4]	RNNQ[3,4]
2006 Jan	1.9	2.1	1.9	2.4	2.3	2.3	2.5	1.4	15.8	10.1
2006 Feb	2.0	2.1	2.0	2.4	2.3	2.3	2.3	1.4	15.2	10.1
2006 Mar	1.8	1.9	1.7	2.4	2.1	2.2	2.2	1.5	13.1	9.2
2006 Apr	2.0	2.1	2.0	2.6	2.4	2.3	2.3	1.9	15.6	9.8
2006 May	2.2	2.3	2.2	3.0	2.9	2.8	2.9	2.0	13.7	8.4
2006 Jun	2.5	2.6	2.4	3.3	3.1	3.2	3.1	2.5	11.3	8.1
2006 Jul	2.4	2.4	2.3	3.3	3.1	3.2	2.6	2.1	10.6	7.7
2006 Aug	2.5	2.6	2.4	3.4	3.3	3.4	2.3	1.7	8.4	6.7
2006 Sep	2.4	2.6	2.3	3.6	3.2	3.3	1.6	1.7	5.4	5.5
2006 Oct	2.4	2.7	2.3	3.7	3.2	3.3	1.3	2.0	3.9	4.5
2006 Nov	2.7	3.0	2.6	3.9	3.4	3.6	1.4	1.9	2.3	2.8
2006 Dec	3.0	3.2	2.9	4.4	3.8	3.9	1.7	1.6	1.7	1.5
2007 Jan	2.7	2.9	2.6	4.2	3.5	3.7	1.5	1.6	–3.4	–0.5
2007 Feb	2.8	2.9	2.6	4.6	3.7	3.9	1.9	2.0	–2.1	–0.2
2007 Mar	3.1	3.1	2.9	4.8	3.9	4.0	2.2	2.2	–0.3	1.0
2007 Apr	2.8	2.9	2.6	4.5	3.6	3.7	1.8	1.8	–1.5	0.0
2007 May	2.5	2.6	2.3	4.3	3.3	3.4	1.9	1.9	0.6	1.9
2007 Jun	2.4	2.5	2.2	4.4	3.3	3.3	1.9	1.7	1.7	2.2
2007 Jul	1.9	2.0	1.7	3.8	2.7	2.6	2.0	1.8	0.3	0.6
2007 Aug	1.8	1.9	1.6	4.1	2.7	2.6	2.1	2.0	–0.2	1.0
2007 Sep	1.8	1.7	1.6	3.9	2.8	2.8	2.6	1.9	6.0	3.6
2007 Oct	2.1	1.9	1.8	4.2	3.1	3.0	3.6	1.8	9.4	4.6
2007 Nov	2.1	1.9	1.8	4.3	3.2	3.0	4.5	1.9	12.1	5.6
2007 Dec	2.1	2.0	1.9	4.0	3.1	3.1	4.7	2.2	13.2	6.9
2008 Jan	2.2	2.1	2.0	4.1	3.4	3.3	5.7	3.0	20.4	11.0
2008 Feb	2.5	2.5	2.3	4.1	3.7	3.6	5.7	2.8	20.9	11.9
2008 Mar	2.5	2.6	2.3	3.8	3.5	3.6	6.2	2.9	20.8	12.7
2008 Apr	3.0	3.0	2.7	4.2	4.0	3.9	7.4	4.1	25.3	16.6
2008 May	3.3	3.3	3.1	4.3	4.4	4.4	9.1	5.6	30.2	18.9
2008 Jun	3.8	3.9	3.6	4.6	4.8	4.9	9.8	5.9	34.1	21.1
2008 Jul	4.4	4.5	4.2	5.0	5.3	5.4	10.0	6.3	31.3	21.3
2008 Aug	4.7	4.9	4.5	4.8	5.2	5.4	9.1	5.7	29.0	20.8
2008 Sep	5.2	5.4	5.0	5.0	5.5	5.6	8.5	5.6	24.1	19.5
2008 Oct	4.5	4.7	4.3	4.2	4.7	4.9	6.7	5.0	16.0	16.9
2008 Nov	4.1	4.3	3.9	3.0	3.9	3.9	5.0	5.0	8.1	14.1
2008 Dec	3.1	4.6	4.1	0.9	2.8	3.9	4.6	5.0	3.2	12.6
2009 Jan	3.0	4.5	4.1	0.1	2.4	3.4	3.5	4.0	1.7	10.8
2009 Feb	3.2	4.6	4.2	0.0	2.5	3.5	3.0	3.7	0.8	8.9
2009 Mar	2.9	4.3	3.9	–0.4	2.2	3.2	2.0	3.2	–0.4	7.5
2009 Apr	2.3	3.8	3.4	–1.2	1.7	2.7	1.3	2.5	–5.8	2.6
2009 May	2.2	3.6	3.3	–1.1	1.6	2.6	–0.3	1.2	–8.8	0.2
2009 Jun	1.8	3.1	2.9	–1.6	1.0	1.9	–1.0	0.3	–12.0	–2.9
2009 Jul	1.8	3.1	2.8	–1.4	1.2	2.1	–1.3	0.2	–12.2	–3.4
2009 Aug	1.6	2.9	2.7	–1.3	1.4	2.3	–0.3	0.8	–7.7	–2.1
2009 Sep	1.1	2.2	2.1	–1.4	1.3	2.0	0.4	1.3	–6.2	–1.2
2009 Oct	1.5	2.6	2.5	–0.8	1.9	2.8	1.7	2.0	0.1	0.8

Notes:

Source: Office for National Statistics

1 The taxes excluded are VAT, duties, insurance premium tax, air passenger duty and stamp duty on share transactions.
2 The taxes excluded are council tax, VAT, duties, vehicle excise duty, insurance premium tax and air passenger duty.
3 Derived from these identification (CDID) codes.
4 These derived series replace those previously shown.

NOTES TO TABLES

Identification (CDID) codes

The four-character identification code at the top of each alpha column of data is the ONS reference for that series of data on our time series database. Please quote the relevant code if you contact us about the data.

Conventions

Where figures have been rounded to the final digit, there may be an apparent slight discrepancy between the sum of the constituent items and the total shown. Although figures may be given in unrounded form to facilitate readers' calculation of percentage changes, rates of change, etc, this does not imply that the figures can be estimated to this degree of precision as they may be affected by sampling variability or imprecision in estimation methods.

The following standard symbols are used:

..	not available
-	nil or negligible
P	provisional
–	break in series
R	revised
r	series revised from indicated entry onwards

CONCEPTS AND DEFINITIONS

Labour Force Survey 'monthly' estimates

Labour Force Survey (LFS) results are three-monthly averages, so consecutive months' results overlap. Comparing estimates for overlapping three-month periods can produce more volatile results, which can be difficult to interpret.

Labour market summary

Economically active

People aged 16 and over who are either in employment or unemployed.

Economically inactive

People who are neither in employment nor unemployed. This includes those who want a job but have not been seeking work in the last four weeks, those who want a job and are seeking work but not available to start work, and those who do not want a job.

Employment and jobs

There are two ways of looking at employment: the number of people with jobs, or the number of jobs. The two concepts are not the same as one person can have more than one job. The number of people with jobs is measured by the Labour Force Survey (LFS) and includes people aged 16 or over who do paid work (as an employee or self-employed), those who have a job that they are temporarily away from, those on government-supported training and employment programmes, and those doing unpaid family work. The number of jobs is measured by workforce jobs and is the sum of employee jobs (as measured by surveys of employers), self-employment jobs from the LFS, people in HM Forces, and government-supported trainees. Vacant jobs are not included.

Unemployment

The number of unemployed people in the UK is measured through the Labour Force Survey following the internationally agreed definition recommended by the ILO (International Labour Organisation) – an agency of the United Nations.

Unemployed people:

- are without a job, want a job, have actively sought work in the last four weeks and are available to start work in the next two weeks, or
- are out of work, have found a job and are waiting to start it in the next two weeks

Other key indicators

Claimant count

The number of people claiming Jobseeker's Allowance benefits.

Earnings

A measure of the money people receive in return for work done, gross of tax. It includes salaries and, unless otherwise stated, bonuses but not unearned income, benefits in kind or arrears of pay.

Productivity

Whole economy output per worker is the ratio of Gross Value Added (GVA) at basic prices and Labour Force Survey (LFS) total employment. Manufacturing output per filled job is the ratio of manufacturing output (from the Index of Production) and productivity jobs for manufacturing (constrained to LFS jobs at the whole economy level).

Redundancies

The number of people, whether working or not working, who reported that they had been made redundant or taken voluntary redundancy in the month of the reference week or in the two calendar months prior to this.

Unit wage costs

A measure of the cost of wages and salaries per unit of output.

Vacancies

The statistics are based on ONS's Vacancy Survey of businesses. The survey is designed to provide comprehensive estimates of the stock of vacancies across the economy, excluding those in agriculture, forestry and fishing. Vacancies are defined as positions for which employers are actively seeking recruits from outside their business or organisation. More information on labour market concepts, sources and methods is available in the *Guide to Labour Market Statistics* at www.statistics.gov.uk/about/data/guides/LabourMarket/default.asp

Directory of online tables

The tables listed below are available as Excel spreadsheets via weblinks accessible from the main *Economic & Labour Market Review* (ELMR) page of the National Statistics website. Tables in sections 1, 3, 4 and 5 replace equivalent ones formerly published in *Economic Trends*, although there are one or two new tables here; others have been expanded to include, as appropriate, both unadjusted/seasonally adjusted, and current price/chained volume measure variants. Tables in sections 2 and 6 were formerly in *Labour Market Trends*. The opportunity has also been taken to extend the range of dates shown in many cases, as the online tables are not constrained by page size.

In the online tables, the four-character identification codes at the top of each data column correspond to the ONS reference for that series on our time series database. The latest data sets for the Labour Market Statistics First Release tables are still available on this database via the 'Time Series Data' link on the National Statistics main web page. These data sets can also be accessed from links at the bottom of each section's table listings via the 'Data tables' link in the individual ELMR edition pages on the website. The old *Economic Trends* tables are no longer being updated with effect from January 2009.

Weblink: www.statistics.gov.uk/elmr/12_09/data_page.asp

Title	Frequency of update
UK economic accounts	
1.01 National accounts aggregates	M
1.02 Gross domestic product and gross national income	M
1.03 Gross domestic product, by category of expenditure	M
1.04 Gross domestic product, by category of income	M
1.05 Gross domestic product and shares of income and expenditure	M
1.06 Income, product and spending per head	Q
1.07 Households' disposable income and consumption	M
1.08 Household final consumption expenditure	M
1.09 Gross fixed capital formation	M
1.10 Gross value added, by category of output	M
1.11 Gross value added, by category of output: service industries	M
1.12 Summary capital accounts and net lending/net borrowing	Q
1.13 Private non-financial corporations: allocation of primary income account[1]	Q
1.14 Private non-financial corporations: secondary distribution of income account and capital account[1]	Q
1.15 Balance of payments: current account	M
1.16 Trade in goods (on a balance of payments basis)	M
1.17 Measures of variability of selected economic series	Q
1.18 Index of services	M
Selected labour market statistics	
2.01 Summary of Labour Force Survey data	M
2.02 Employment by age	M
2.03 Full-time, part-time and temporary workers	M
2.04 Public and private sector employment	Q
2.05 Workforce jobs	Q
2.06 Workforce jobs by industry	Q
2.07 Actual weekly hours of work	M
2.08 Usual weekly hours of work	M
2.09 Unemployment by age and duration	M
2.10 Claimant count levels and rates	M
2.11 Claimant count by age and duration	M
2.12 Economic activity by age	M
2.13 Economic inactivity by age	M
2.14 Economic inactivity: reasons	M
2.15 Educational status, economic activity and inactivity of young people	M
2.16 Average earnings – including bonuses	M
2.17 Average earnings – excluding bonuses	M
2.18 Productivity and unit wage costs	M
2.19 Regional labour market summary	M

Weblink: www.statistics.gov.uk/elmr/12_09/data_page.asp

2.20	International comparisons	M
2.21	Labour disputes	M
2.22	Vacancies	M
2.23	Vacancies by industry	M
2.24	Redundancies: levels and rates	M
2.25	Redundancies: by industry	Q
2.26	Sampling variability for headline labour market statistics	M

Prices

3.01	Producer and consumer prices	M
3.02	Harmonised Indices of Consumer Prices: EU comparisons	M

Selected output and demand indicators

4.01	Output of the production industries	M
4.02	Engineering and construction: output and orders	M
4.03	Motor vehicle and steel production[1]	M
4.04	Indicators of fixed investment in dwellings	M
4.05	Number of property transactions	M
4.06	Change in inventories[1]	Q
4.07	Inventory ratios[1]	Q
4.08	Retail sales, new registrations of cars and credit business	M
4.09	Inland energy consumption: primary fuel input basis[1]	M

Selected financial statistics

5.01	Sterling exchange rates and UK reserves	M
5.02	Monetary aggregates	M
5.03	Counterparts to changes in money stock M4[1]	M
5.04	Public sector receipts and expenditure	Q
5.05	Public sector key fiscal indicators	M
5.06	Consumer credit and other household sector borrowing	M
5.07	Analysis of bank lending to UK residents	M
5.08	Interest rates and yields	M
5.09	A selection of asset prices	M

Further labour market statistics

6.01	Working-age households	A
6.02	Local labour market indicators by unitary and local authority	Q
6.03	Employment by occupation	Q
6.04	Employee jobs by industry	M
6.05	Employee jobs by industry division, class or group	Q
6.06	Employee jobs by region and industry	Q
6.07	Key productivity measures by industry	M
6.08	Total workforce hours worked per week	Q
6.09	Total workforce hours worked per week by region and industry group	Q
6.10	Job-related training received by employees	Q
6.11	Unemployment rates by previous occupation	Q
6.12	Average Earnings Index by industry: excluding and including bonuses	M

Weblink: www.statistics.gov.uk/elmr/12_09/data_page.asp

6.13	Average Earnings Index: effect of bonus payments by main industrial sector	M
6.14	Median earnings and hours by main industrial sector	A
6.15	Median earnings and hours by industry section	A
6.16	Index of wages per head: international comparisons	M
6.17	Regional Jobseeker's Allowance claimant count rates	M
6.18	Claimant count area statistics: counties, unitary and local authorities	M
6.19	Claimant count area statistics: UK parliamentary constituencies	M
6.20	Claimant count area statistics: constituencies of the Scottish Parliament	M
6.21	Jobseeker's Allowance claimant count flows	M
6.22	Number of previous Jobseeker's Allowance claims	Q
6.23	Interval between Jobseeker's Allowance claims	Q
6.24	Average duration of Jobseeker's Allowance claims by age	Q
6.25	Vacancies by size of enterprise	M
6.26	Redundancies: re-employment rates	Q
6.27	Redundancies by Government Office Region	Q
6.28	Redundancy rates by industry	Q
6.29	Labour disputes: summary	M
6.30	Labour disputes: stoppages in progress	M

Notes:

1 These tables, though still accessible, are no longer being updated.
A Annually
Q Quarterly
M Monthly

More information

Time series are available from www.statistics.gov.uk/statbase/tsdintro.asp
Subnational labour market data are available from www.statistics.gov.uk/statbase/product.asp?vlnk=14160 and www.nomisweb.co.uk
Labour Force Survey tables are available from www.statistics.gov.uk/statbase/product.asp?vlnk=14365
Annual Survey of Hours and Earnings data are available from www.statistics.gov.uk/statbase/product.asp?vlnk=13101

Contact points

Recorded announcement of latest RPI
01633 456961
rpi@ons.gsi.gov.uk

Labour Market Statistics Helpline
01633 456901
labour.market@ons.gsi.gov.uk

Earnings Customer Helpline
01633 819024
earnings@ons.gsi.gov.uk

National Statistics Customer Contact Centre
0845 601 3034
info@statistics.gsi.gov.uk

Skills and Education Network
024 7682 3439
senet@lsc.gov.uk

Department for Children, Schools and Families Public Enquiry Unit
0870 000 2288

For statistical information on

Average Earnings Index (monthly)
01633 819024

Claimant count
01633 456901

Consumer Prices Index
01633 456900
cpi@ons.gsi.gov.uk

Earnings
Annual Survey of Hours and Earnings
01633 456120

Basic wage rates and hours for manual workers with a collective agreement
01633 819008

Low-paid workers
01633 819024
lowpay@ons.gsi.gov.uk

Labour Force Survey
01633 456901
labour.market@ons.gsi.gov.uk

Economic activity and inactivity
01633 456901

Employment
Labour Force Survey
01633 456901
labour.market@ons.gsi.gov.uk

Employee jobs by industry
01633 456776

Total workforce hours worked per week
01633 456720
productivity@ons.gsi.gov.uk

Workforce jobs series – short-term estimates
01633 456776
workforce.jobs@ons.gsi.gov.uk

Labour costs
01633 819024

Labour disputes
01633 456721

Labour Force Survey
01633 456901
labour.market@ons.gsi.gov.uk

Labour Force Survey Data Service
01633 455732
lfs.dataservice@ons.gsi.gov.uk

New Deal
0114 209 8228

Productivity and unit wage costs
01633 456720

Public sector employment
General enquiries
01633 455889

Source and methodology enquiries
01633 812865

Qualifications (Department for Children, Schools and Families)
0870 000 2288

Redundancy statistics
01633 456901

Retail Prices Index
01633 456900
rpi@ons.gsi.gov.uk

Skills (Department for Innovation, Universities & Skills)
0870 001 0336

Skill needs surveys and research into skill shortages
0870 001 0336

Small firms (BERR)
Enterprise Directorate
0114 279 4439

Subregional estimates
01633 812038

Annual employment statistics
annual.employment.figures@ons.gsi.gov.uk

Annual Population Survey, local area statistics
01633 455070

Trade unions (BERR)
Employment relations
020 7215 5934

Training
Adult learning – work-based training (DWP)
0114 209 8236

Employer-provided training (Department for Innovation, Universities & Skills)
0870 001 0336

Travel-to-Work Areas
Composition and review
01329 813054

Unemployment
01633 456901

Vacancies
Vacancy Survey: total stocks of vacancies
01633 455070

ONS economic and labour market publications

ANNUAL

Financial Statistics Explanatory Handbook

2009 edition. Palgrave Macmillan, ISBN 978-0-230-52583-2. Price £47.50.

www.statistics.gov.uk/StatBase/Product.asp?vlnk=4861

Foreign Direct Investment (MA4)

2007 edition

www.statistics.gov.uk/StatBase/Product.asp?vlnk=9614

Input-Output analyses for the United Kingdom

2006 edition

www.statistics.gov.uk/StatBase/Product.asp?vlnk=7640

Research and development in UK businesses (MA14)

2006 edition

www.statistics.gov.uk/StatBase/Product.asp?vlnk=165

Share Ownership

2006 edition

www.statistics.gov.uk/StatBase/Product.asp?vlnk=930

United Kingdom Balance of Payments (Pink Book)

2009 edition. Palgrave Macmillan, ISBN 978-0-230-57610-0. Price £52.00.

www.statistics.gov.uk/StatBase/Product.asp?vlnk=1140

United Kingdom National Accounts (Blue Book)

2009 edition. Palgrave Macmillan, ISBN 978-0-230-57611-7. Price £52.00.

www.statistics.gov.uk/StatBase/Product.asp?vlnk=1143

Statistical Bulletins

- Annual survey of hours and earnings
- Foreign direct investment
- Gross domestic expenditure on research and development
- Low pay estimates
- Regional gross value added
- Share ownership
- UK Business enterprise research and development
- Work and worklessness among households

QUARTERLY

Consumer Trends

2009 quarter 2

www.statistics.gov.uk/StatBase/Product.asp?vlnk=242

United Kingdom Economic Accounts

2009 quarter 2. Palgrave Macmillan, ISBN 978-0-230-23488-8. Price £37.50.

www.statistics.gov.uk/StatBase/Product.asp?vlnk=1904

UK trade in goods analysed in terms of industry (MQ10)

2009 quarter 2

www.statistics.gov.uk/StatBase/Product.asp?vlnk=731

Statistical Bulletins

- Balance of payments
- Business investment
- GDP preliminary estimate
- Government deficit and debt under the Maastricht Treaty (six-monthly)
- International comparisons of productivity (six-monthly)
- Internet connectivity
- Investment by insurance companies, pension funds and trusts
- Productivity
- Profitability of UK companies
- Public sector employment
- Quarterly National Accounts
- UK output, income and expenditure

MONTHLY

Financial Statistics

November 2009. Palgrave Macmillan, ISBN 978-0-230-23602-8. Price £50.00.

www.statistics.gov.uk/StatBase/Product.asp?vlnk=376

Focus on Consumer Price Indices

October 2009

www.statistics.gov.uk/StatBase/Product.asp?vlnk=867

Monthly review of external trade statistics (MM24)

September 2009

www.statistics.gov.uk/StatBase/Product.asp?vlnk=613

Producer Price Indices (MM22)

October 2009

www.statistics.gov.uk/StatBase/Product.asp?vlnk=2208

Statistical Bulletins

- Consumer price Indices
- Index of production
- Index of services
- Labour market statistics
- Labour market statistics: regional
- Producer prices
- Public sector finances
- Retail sales
- UK trade

OTHER

The ONS Productivity Handbook: a statistical overview and guide

Palgrave Macmillan, ISBN 978-0-230-57301-7. Price £55.

www.statistics.gov.uk/about/data/guides/productivity/default.asp

Labour Market Review

2009 edition. Palgrave Macmillan, ISBN 1-4039-9735-7. Price £40.

www.statistics.gov.uk/StatBase/Product.asp?vlnk=14315

National Accounts Concepts, Sources and Methods

www.statistics.gov.uk/StatBase/Product.asp?vlnk=1144

Sector classification guide (MA23)

www.statistics.gov.uk/StatBase/Product.asp?vlnk=7163

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Graeme Chamberlin

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List is provisional and subject to change.

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